

INTRODUCTION

With the increased tempo of U.S. Navy operations in the Indian Ocean, there has been a matching increase in concern over the environmental support available to the Fleet meteorologists. As part of the NAVENVPREDRSCHFAC effort to improve that support, this Command has reprinted a series of meteorological handbooks -- collectively titled Weather In The Indian Ocean -- that were originally issued by the British Government in the 1940-44 time frame.

These handbooks, published as three volumes in a total of twelve parts, were prepared by the Meteorological Office, Air Ministry, in cooperation with the Naval Meteorological Branch, Admiralty, London. Titles of all volumes/parts in the series are given below.

Because the series has long been out of print, the NAVENVPREDRSCHFAC has obtained permission to reprint and distribute the handbooks to U.S. Navy units. As in the original publication, this new reprinting ultimately will comprise twelve individual books, each marked with volume and part number; the reprint set is distributed as NAVENVPREDRSCHFAC Technical Bulletin 80-02, April 1980. The books are three-hole-punched for collection into ring binders. There has been no editing or changing of the original material.

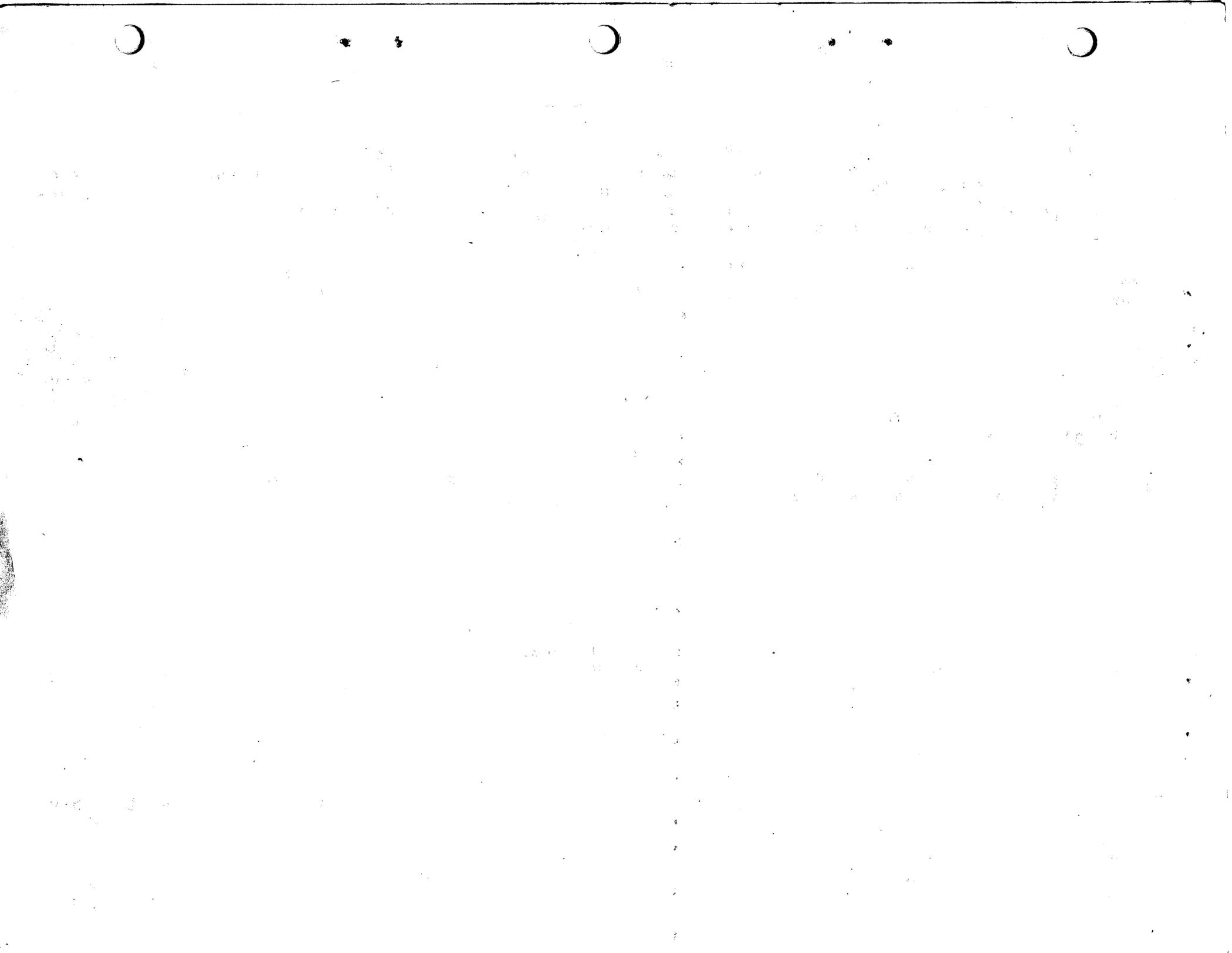
Users of the series should be alert to the fact that a number of place names used in the original writing have changed over the intervening years.

Volumes/parts titles in the series are as follows:

- Vol. I ---- Weather In The Indian Ocean - General Information (in one part)
- Vol. II --- Weather In The Indian Ocean to Latitude 30°S and Longitude 95°E including the Red Sea and Persian Gulf (in nine parts; see parts titles below)
- Vol. III -- Weather In The Indian Ocean - Aids To Forecasting (in two parts:
1, Indian Ocean; and 2, North Indian Ocean)

Parts titles, Volume II (local information):

1. Red Sea
2. The Gulf of Aden and West Arabian Sea to Longitude 00°E
3. The Persian Gulf and Gulf of Oman
4. The Makran Coast from Gwadar to Karachi and the West Coast of India to Latitude 20°N
5. West Coast of India from Latitude 20°N to Cape Comorin, with an Appendix on Conditions at Bombay
6. A. East Coast of India from Cape Comorin to the Ganges Delta -- B. Ceylon
7. The Coast of Burma
8. The South Indian Ocean to Latitude 30°S.
9. Coast of East Africa from the Equator to Cape Delgado



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THE PERSIAN GULF
AND
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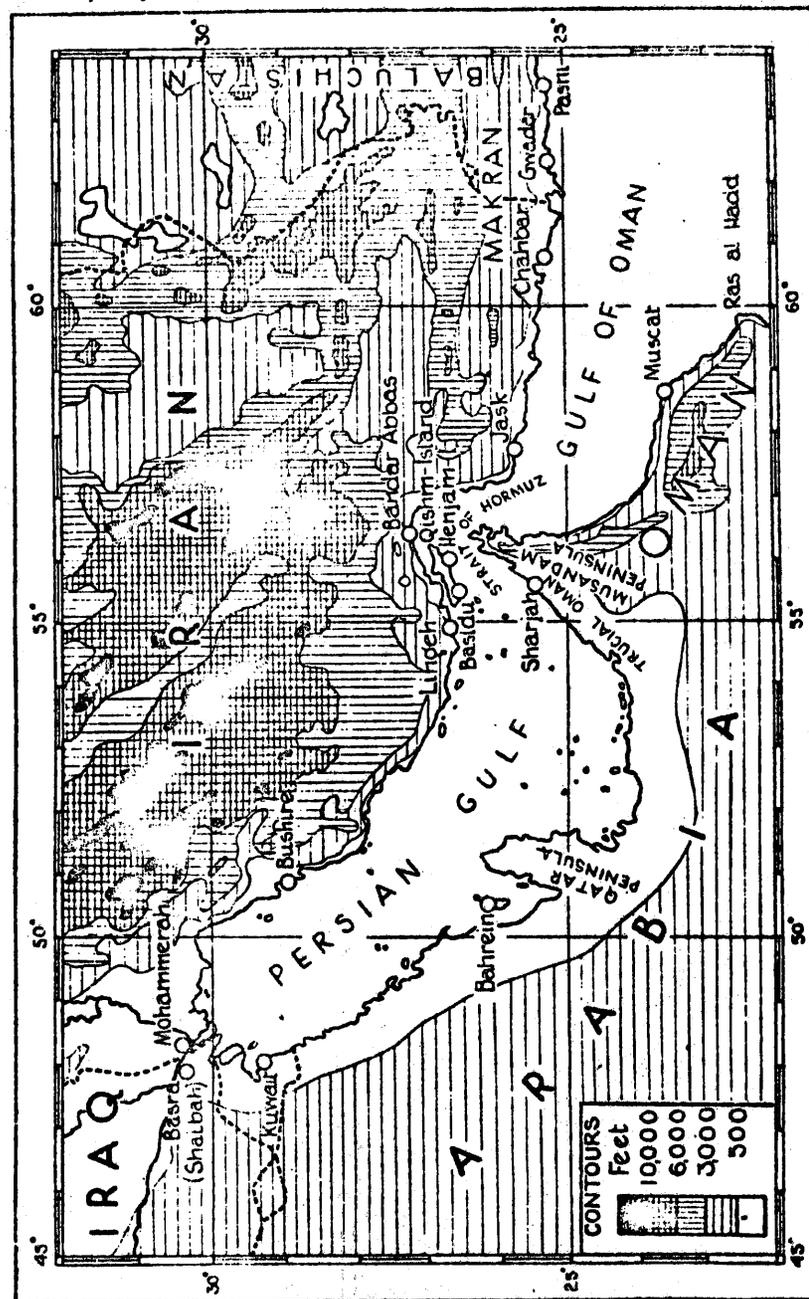


FIG. 1—THE PERSIAN GULF AND GULF OF OMAN

THE PERSIAN GULF AND GULF OF OMAN

INCLUDING
THE PART OF THE MAKRAN COAST WEST OF GWADAR

I—GENERAL

The Persian gulf and the Gulf of Oman lie between the parallels of 23° N. and 30° N. and the meridians of 48° E. and 62° E.

The Persian gulf is approximately 450 nautical miles in length and its width varies from about 100 to 180 nautical miles; its waters are comparatively shallow, rarely exceeding 40 or 50 fathoms in depth.

The approach to the Persian gulf from the Arabian sea is through the Gulf of Oman and the Strait of Hormuz, the width of which at its south-eastern end is about 30 nautical miles. The Gulf of Oman is very deep in the middle; the greatest depth of over 2,000 fathoms is off Muscat.

Both the Persian gulf and the Gulf of Oman are bounded on the south and west by the peninsula of Arabia and on the north and east by the main continent of Asia. The south-western or Arabian shore of the Persian gulf is very low-lying and consists for the most part of desert, extensive tracts of which are quite uninhabited. The south-western shore of the Gulf of Oman is more mountainous and rises steeply from the sea to above 6,000 feet in places.

On the north, the Persian gulf and the Gulf of Oman are bounded by the Iranian and the Makran coasts; the country is mountainous and the land rises steeply to the tablelands of Iran and Baluchistan. In some places these tablelands rise to about 3,000 feet direct from sea level and to above 10,000 feet further inland, some of the mountains being snow-capped for a great part of the year. Wide valleys separate the mountains, and there are strips of low land of varying width between them and the sea.

The year has been divided into the following four seasons:—

- (i) Winter, December to February.
- (ii) Spring, March to May.
- (iii) Summer, June to September.
- (iv) Autumn, October to November.

The weather may be divided into two main types, winter and summer. In the winter months, December to February, a tongue of the winter anticyclone of central Asia extends over Iran, while depressions from the west frequently pass through the region. The

marked variation of the weather during these months depends both on the movement of these depressions and also on the position and intensity of the central Asiatic anticyclone.

These western depressions are a notable feature of the weather, they may occur at any time between October and May but are most frequent in the winter months, and for that reason winter is the period with the most disturbed weather. The depressions are accompanied by cloudy skies and rain and sometimes also by squalls and thunderstorms. From November to April the climate is cold, dry and bracing; at times the wind may be cold and cutting but on the whole the climate in this season is said to compare quite favourably with that of Egypt.

In the summer months, June to August, a large low-pressure area is centred roughly over north-west India and extends westwards to Arabia; very occasionally depressions from the east, which have originated in the Arabian sea or have travelled across India from the Bay of Bengal, move westwards and enter this low-pressure area. The variation of the weather in the summer months is determined by the position and intensity of this low-pressure area and also to a small extent by these eastern depressions. The eastern depressions may occur at any time between May and October, but by the time they reach the Gulf of Oman they have lost much of their vitality and are not nearly so vigorous as the western depressions of winter.

The SW. monsoon, which blows over the Arabian sea from May to September, has little effect on the weather of the Gulf of Oman and still less on that of the Persian gulf. In the Gulf of Oman an off-shoot of the monsoon blows as a south-easterly wind, but it is by no means strong and does not penetrate westward of a line drawn between Bandar Abbas and the Musandam peninsula. In the Persian gulf the prevailing winds in summer are north-westerly, the sky is cloudless and no rain falls; the Gulf of Oman also is practically rainless in summer, though heavy rainstorms occur occasionally east of Jask.

In the summer months the temperatures experienced are exceedingly high and at most places in the region the heat is intense, mean temperatures lying between 87° and 93° F. During the day, temperatures of more than 100° F. are by no means uncommon and they may occasionally rise to more than 110° F. On the coast, however, these temperatures are modified by slightly cooler sea-breezes. The intense heat is aggravated by the humidity of the atmosphere and the dust raised by the wind, and in the Persian gulf there is no rain or cloud to temper it. With the exception of the town of Kuwait, the Arabian coast of the Persian gulf is hotter and less healthy than the Iranian; the heat is greater at the southern end of the gulf than at the head.

Spring and autumn are transition periods when the weather conditions are changing over from winter to summer and summer to winter types respectively. During these periods both types of

weather may be experienced, but their effects are not usually well-marked and only local disturbances of the weather, without a regular sequence of events, should be expected.

The climate of the region as a whole has an unenviable but to some extent undeserved reputation. The Anglo-Iranian Oil Company, which employs a large number of Europeans in the region, many of whom work in the open, have shown that by providing all their employees with proper quarters and the necessary amenities of life in a hot climate, the health of their staff is actually better in summer than in winter, and at all times better than that of similar types of workers in any part of India. The Admiralty also are able to keep the European crews of the warships stationed in the Persian gulf as healthy as those in the Mediterranean.

Summary of local weather conditions

The following notes describe the weather that is to be expected in different seasons of the year at certain places in the Persian gulf and the Gulf of Oman:—

Basra and the Shatt al 'Arab.—Winter (December to February).—The winter at Basra is not unlike that in England except that there are no gales and the temperature is considerably higher; when the sky has been cloudless the temperature at 1500 may rise to 75° F. and on rare occasions to 80° F. or more. Ground frost may be expected on most mornings in January and February, but it is only during extreme conditions, once perhaps in about four years, that the temperature drops below freezing point on board ship.

The winds are usually light and blow either directly up or down the river; the direction at Basra being SE. or NW. The latter direction is the more usual but the wind is very variable and calms are frequent. The NW. winds are cool and invigorating and are said to be a harbinger of settled weather, whereas SE. winds foreshadow rain.

Rain or drizzle may be expected whenever the sky is cloudy and sometimes this may occur on three or four days in a week; snow is unknown.

Fog is uncommon; it may occur occasionally in the early morning, but it usually clears before noon.

Spring (March to May).—The climate in spring is very pleasant, the temperature rising steadily from the relatively cool days of March to the fiery heat of the summer. In H.M. ships the change from blue to white uniform usually takes place about the middle of April.

On most days the sky is cloudless, but a cumulus cloud may occasionally be seen. A gentle breeze blows down the river from 1000 until sunset; on perhaps one day in the week it may exceed Beaufort force 3 but it very seldom exceeds force 5. The wind

brings surprisingly little sand with it. Very occasionally the wind may go round to the south and the sky may then become overcast but rain is rare during this season.

Insect life, which abounds both on shore and on board those ships lying alongside the jetties, is the only thing that mars the otherwise pleasant weather conditions. Ships moored in the stream are a little more immune from the visitations of the myriads of mosquitoes which infest the river, but they are by no means safe from them. After June, however, the hot weather kills off all the insects.

Summer (June to August).—The climate of Basra in summer compares very favourably in respect of humidity with other parts of the Persian gulf, and for this reason it is the most comfortable harbour in which to lie during the height of the hot weather.

Temperatures of over 120° F. are occasionally recorded during August; the normal temperature in the afternoon is between 105° and 110° F., but the rapid cooling of the land at night causes the temperature to drop nearly 30° F. The kaus or SE. wind is said to engender prickly heat.

A breeze invariably springs up at noon and dies down at sunset. On nine days out of ten it blows directly down the river but occasionally its direction is reversed. The force of the wind seldom exceeds Beaufort force 2, so that there is usually not a great deal of sand in the air, and it is exceptional for the traffic in the river to be disorganised by a sandstorm on more than one day in the month.

A ship leaving the Shatt al 'Arab in this season will experience a rise in the relative humidity while still in the Khōr al Rooka and the wet-bulb thermometer will rise as much as 8° F. before the ship is out of sight of land.

Autumn (September to November).—A distinct drop in the temperature is felt at Basra at the beginning of October. This is especially noticeable at night when the temperature will sometimes fall as much as 20° F. after sunset; the day temperature, however, falls more gradually as the season advances. In H.M. ships the change from white to blue uniform usually takes place about the end of November.

The wind conditions are similar to those prevailing during the remainder of the year. Morning fogs are said to be frequent in October, and from the middle of November the sky may be cloudy on three days in the week and rain is likely.

Mosquitoes return with the cooler weather but they are not so prevalent as in June.

Bahrein including the south-west coast of the Persian gulf.—April to June.—In H.M. ships at Bahrein, the change from blue uniform to white usually takes place at the beginning of April,

and the whole of that month is pleasantly warm. The sky at the beginning of the season is frequently cloudy, and occasionally completely overcast, but rain is rare. Squalls may be experienced at times in March, and the wind in these squalls is not limited to any particular direction.

In May the weather becomes more trying and, although the temperature is not exceptionally high, the very muggy conditions experienced are only relieved by the shamal which usually begins to blow before the middle of the month. From the beginning of June onwards this wind blows from a north-westerly direction with only few breaks; it varies in strength from very light to Beaufort force 6 or 7. In the afternoon its force is 3 or 4 of the Beaufort scale on about 70 per cent. of the days; it decreases at night, but periods with stronger forces may set in without warning and forces of 5 to 7 may be maintained for several days on end. The warship anchorage at Khör Kaliya then becomes unpleasant for boat-work, but this is seldom impossible and the holding ground leaves little to be desired.

The 40-day shamal (see page 34) sweeps the whole of the Persian gulf from Kuwait to the Musandam peninsula and renders most anchorages unpleasant. During the shamal it is impossible to pay a prolonged visit to the Trucial coast of the Persian gulf as landing in boats cannot be effected and ships frequently drag their anchors. Bushire, on the Iranian coast, also seems to receive the full strength of this wind and boat-work has to be suspended. At Kuwait, on the other side, the conditions are little better as the shamal blows across the tide.

The visibility varies a great deal; when the wind is strong it is usually over 20 miles, but at other times, although it is sometimes good, it cannot be relied upon; usually it is below 10 miles, whilst on about one day in ten it is definitely poor. Heavy sandstorms seldom occur during this season, but over and near the land there is always some haze which may hide the low-lying shore until a ship is within a few miles of it. In April, at Bahrein, an occasional thick sea fog is experienced in the morning which clears between 1000 and 1100.

July to September.—The 40-day shamal ceases to blow towards the middle of July and possibly earlier at Bahrein which then becomes almost unbearably hot. Although there is very little actual rise in temperature, the excessive heat is felt owing to the lack of wind and the rise in relative humidity. At 1500 when the dry-bulb thermometer is seldom above 100° F. the wet bulb frequently reaches 90° F. Fortunately a light breeze often springs up in the afternoon but, except for perhaps one day in the week, it invariably dies down at dusk and the nights are even more humid than the days. This afternoon breeze at Bahrein usually blows from between NW. and N. and seldom exceeds Beaufort force 2.

The following remarks on the conditions on board a ship at night at Bahrein during this season are of interest:—

As the temperature of the sea by the end of August reaches 96°F., ships have no chance of cooling down after sunset, and it is therefore more comfortable to sleep under a fan between decks than in the still damp air in the open. Fortunate, indeed, is the person who may sleep ashore where the slight drop in temperature at night can be appreciated to the full.

The sky throughout this season is cloudless and, on the whole, the visibility at sea is good and sometimes excellent, although the wind may bring sand with it from any direction. The more common dust haze, which reduces the visibility to about five miles, can usually be expected on three days a week, while thick sandstorms, reducing the visibility to less than one mile, are only produced by fairly strong south winds which do not occur on more than one day in ten. Over and near the land the visibility is invariably worse than at sea and sometimes a bright moon shining on a calm humid atmosphere has been known to produce the effect of a mist when the actual visibility has been moderate.

Conditions very similar to those at Bahrein exist over all the Persian gulf during this season but they are usually less severe in the extreme north.

October to March.—At Bahrein the end of the summer is often marked by the arrival of the first shamal of the winter type (see page 34) but, even if this does not come to clear the air, a distinct change for the better in the climatic conditions sets in towards the end of September. The temperature drops gradually from the beginning of October, and in H.M. ships blue uniform is usually worn early in December.

The wind generally blows from the NW. during the day, reaching forces between 2 and 3 of the Beaufort scale at about noon. Stronger north-westerly winds (shamals) are, however, to be expected, and are liable to come without warning; it is impossible to give any set rule as to their frequency, but one or two a month during the autumn and twice that number during the winter is a fair average. The barometer may not give any indication of their arrival or passing, but the wind may increase from force 3 to force 6 or 7 of the Beaufort scale in half an hour. A shamal of this type may often last for 2 days, and, when a lull comes, there is no means of predicting whether it will continue or whether it will only last for an hour or so. These shamals render boat-work difficult at Khör Kaliya (c 26° 11' N., 50° 40' E.) and almost impossible in exposed anchorages such as Kuwait, Bushire and those on the Trucial coast. The nights are calm. Apart from these shamals the weather is good, and after October the muggy atmosphere of the spring and summer is no longer noticeable.

The sky which is usually cloudless in October becomes more covered as the season progresses, until in December and January it is occasionally overcast, and rain or drizzle may be experienced on two or three days in each month.

The visibility is exceptionally good during this period, but on the few occasions when a southerly wind is blowing there may be some sand in the air which will reduce the visibility to less than 10 miles; on the other hand, it is quite usual for conspicuous objects such as mountains or the flares from oil refineries to be sighted at distances of nearly 100 miles. At Bahrein thick early morning mist is sometimes experienced.

Khör Kuwai, situated off the western end of the Musandam peninsula, is on the dividing line between the Persian gulf and Gulf of Oman; it experiences therefore a combination of the types of climate of both those regions. In the summer, from about the beginning of June to the middle of September, the weather is muggy and consequently unpleasant; during the winter months it is difficult to predict the temperature from week to week, during some periods it may be tropical whilst at others it may be cool enough for blue uniform to be worn.

A peculiarity of the climate is the strong southerly gales which occur about the month of March. These gales do not hamper boat-work much as there is not sufficient scope for the waves to rise, but ships have to take precautions against dragging as the holding ground is not good.

Thick fog has been encountered around the Quoins in April, but this is most exceptional.

Muscat including the coast of Oman from Ras al Hadd to the end of the Musandam peninsula.—*January to April*.—The climate of the Gulf of Oman during this period is warmer than that of the Persian gulf, but it is not uncomfortably hot or muggy. In H.M. ships blue uniform is never worn except perhaps at Khör al Jarāmah (22° 34' N., 59° 39' E. approx.) in January.

The wind is usually north-westerly at Muscat and variable elsewhere but shamals with Beaufort force between 6 and 7 occur frequently in February and March. They raise short steep seas and low swells which sweep into the harbour at Muscat and also render the other anchorages on these coasts untenable. It is sometimes possible for ships which have been driven from Muscat to find some shelter in Matrah bay (23° 38' N., 58° 34' E.) where boat-work can be carried out in reasonable security.

The visibility is usually more than 10 miles, and during calm weather or when a light wind from a northerly direction is blowing it is usually excellent.

In January there is risk of occasional rain but this is less in the later months.

May to July.—The summer heat reaches its greatest intensity in these regions in June. At this time of year Muscat is probably one of the hottest harbours in the world, as the sun is directly overhead at noon and the surrounding barren and rocky hills reflect

its rays. A light south-easterly wind, an offshoot of the SW. monsoon, is felt on most days but it can only enter the harbour of Muscat through the small opening between Muscat island and the mainland. It is customary, therefore, for ships that are remaining for any length of time, to secure their sterns to a rock in order to lie across this breeze.

Further south along the coast the wind is more constant and increases to force 3 of the Beaufort scale. At Khör al Jarāmah (22° 34' N., 59° 39' E.), where the mountain ranges are further inland and the coast-line consists of low sandy cliffs, the temperature is not unpleasant and it is not noticeably muggy; clouds occasionally roll up from the southward and have been known to bring a few drops of rain.

Conditions on the coast northward of Muscat are no better than at Muscat. The heat of Muscat is fairly dry but at Khör Kalba (25° 04' N., 56° 20' E. approx.), for example, where the temperature is lower and the south-easterly breeze is no longer felt, the decks and awnings on board ship run with moisture at night. There is usually a slight breeze in the afternoon which helps to alleviate matters, but this dies away at sunset.

A low swell, the result of the SW. monsoon, is felt in the Gulf of Oman and reaches beyond Muscat but it does not enter that harbour, whilst further north the sea is calm.

The visibility at this season is rarely poor and the mountains to the north of Khör Kalba usually stand out clearly at great distances; further south distant objects are often obscured by haze. The visibility is generally about 20 miles.

August to December.—In August Muscat becomes cooler and the climate on this coast is more pleasant than that on the western side of the Musandam peninsula. The temperature of the sea is lower than in the confined waters of the Persian gulf and the atmosphere is not so muggy. November and December are delightful months, when it is just sufficiently warm for white uniform to be worn in H.M. ships.

The wind at Muscat is variable, and in the afternoon is usually from a northerly direction and of Beaufort force between 2 and 3; it is very seldom during the later months of the year that the northerly wind is sufficiently strong to hamper boat-work in the harbour. The effect of the land breeze at night is either to decrease the strength of the wind or to give rise to a wind from some direction between SE. and W.

The visibility is very good during these months and the sky is often cloudless, although on one or two days in the month it may be one to two tenths covered with cirrus cloud.

II —PRESSURE

The distribution of average barometric pressure on the coasts of the Persian gulf and its approaches may be considered under the two main seasonal types of winter and summer.

In the winter, December to February, a region of high pressure is centred over central Asia and the average pressure over the Persian gulf and Gulf of Oman is about 1018 mb. In the summer, June to August, an extensive area of low pressure is centred over north-west India and the average pressure over the region is then just under 1000 mb. During the intervening periods, September to November and March to May, the pressure distribution is changing from one type to the other.

Over the whole region the pressure reaches its lowest value in July when the average is about 998 mb. It rises continuously to its highest value of 1019 mb. in January and then gradually falls; the range of the average monthly values is thus about 21 mb. The most rapid rise takes place between September and October and the most rapid fall between May and June.

In a period of ten years the extreme range of pressure at Basra (Shaibah) was 43 mb., from 1033 mb. on January 1, 1937 to 990 mb. on July 26, 1932. The changes of pressure are much greater in winter than in summer: during the same period of years the extreme range of the barometer in January was 31 mb. compared with only 14 mb. in July.

In the Persian gulf the barometer cannot, as a rule, be relied upon to give warning of the approach of bad weather. The worst weather sometimes occurs without any change in the pressure, or if a change takes place it does not occur until after the gale has set in. On the western part of the Makran coast the barometer is usually a better guide to the weather falling before bad weather sets in.

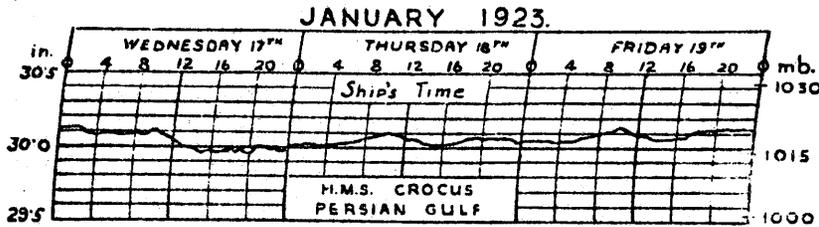


FIG. 2—BAROGRAPH TRACE DURING A SHAMAL IN THE PERSIAN GULF

At noon on the 17th conditions were normal, by 1600 the sky was completely overcast and at 2315 there was a violent squall of Beaufort force 7-8 with heavy rain. Two more squalls, also accompanied by torrential rain, passed over at 0040 and 0150 on the 18th during which the wind rose to force 10. The wind then gradually eased to force 2 but freshened again to force 6 by 0900, and it was estimated that it continued to blow with force 4 to 6 for the next 24 hours. (From the *Marine Observer*, Vol. 1, January, 1924.)

Shamals and squalls may often occur without barometric warning. This is well illustrated by the barogram (Fig. 2) which was

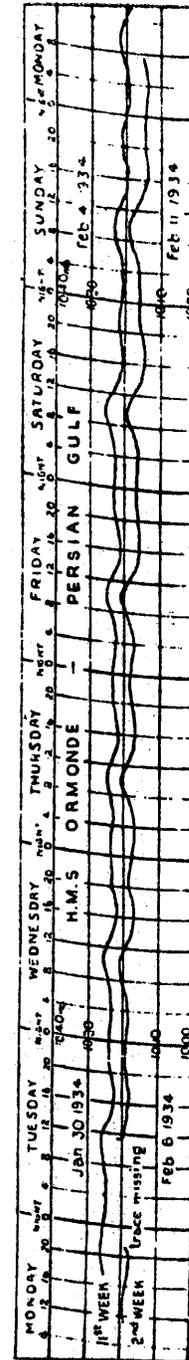


FIG. 3—BAROGRAPH TRACE SHOWING ABNORMAL DIURNAL VARIATION OF PRESSURE IN THE PERSIAN GULF. Note the single maximum at 1000 and the single minimum at 1600.

obtained by H.M.S. *Crocus* while cruising off the western side of the Musandam peninsula. The ship reported that although a severe shamal was experienced from January 17-19 the barometer readings were only such as might have been expected under normal weather conditions.

The diurnal variation of the barometer in the Persian gulf is similar to that observed elsewhere in similar latitudes, with two maxima at about 1000 and 2200 and two minima at about 0400 and 1600. The diurnal range is between 2 and 3 mb.

Occasionally during the winter the evening maximum and morning minimum are absent, and the pressure rises gradually from 1600 until 1000 on the following day. This abnormal diurnal variation of the barometer is illustrated in Fig. 3, which shows a barograph trace obtained by H.M.S. *Ormonde* from January 29 to February 12, 1934 whilst on her surveying ground at Sir Beni Yas (24° 30' N., 52° 40' E.) and at Henjam (26° 42' N., 55° 54' E.). The trace is of interest as it shows also the remarkable similarity in the records for two consecutive weeks.

III —DEPRESSIONS AND TROPICAL CYCLONES

In the cold season the whole area comes under the influence of western depressions; in the summer the weather is of a more settled type though occasionally it may be influenced to a small extent by depressions coming from the east. During the change-of-season periods the weather may be disturbed locally but there is not likely to be any regular sequence of events.

I —WESTERN DEPRESSIONS

During the cold season from November to April depressions not infrequently approach India from the west, and these are known by the India Meteorological Department as western disturbances. Most of them have their origin in the Mediterranean and travel eastwards through north Arabia and Iraq, but there is some evidence that, in mid-winter, if the anticyclone over Iran intensifies considerably and causes an outflow of cold air over the Persian gulf to Arabia, depressions may form in the interior of Arabia. Sometimes secondaries to western depressions develop in the lee of the mountains of Iran and Caucasia.

The average frequency of western depressions over the Persian gulf is shown in the following table:—

Jan.	Feb.	Mar.	Apr.-Oct.	Nov.	Dec.	Year
6	8	6	infrequent	5	6	31

Occasionally depressions may affect the area as early as September or October and as late as April or May; normally they move along their most southerly tracks in mid February and then gradually recede northwards. In the summer months the outbursts of polar air are mostly confined to higher latitudes, and no depressions pass over the Persian gulf, though the effects of depressions travelling to north may sometimes be felt.

The passage of an active depression over the Persian gulf is accompanied by the same types of frontal phenomena as are characteristic of depressions of middle latitudes, but they are likely to be of less intensity. Very frequently the warm front does not extend as far south as the Persian gulf and in consequence many more cold fronts pass over Basra than warm fronts. The depressions are fairly vigorous over the Persian gulf; they tend to decrease in intensity as they proceed eastwards though not infrequently they intensify again over north-west India.

When a depression approaches the Persian gulf the normally dry, cold, NW. winds over the upper part of the gulf change to between ESE. and SSW. Gradually the air becomes warmer and more humid, clouds increase and become lower, temperature rises, and drizzle or fog may occur. After the passage of the warm front there is generally fair weather away from the coast; but on the Iranian coast, where the convectional movement is intensified by the hills, the rain may be heavy with the approach of the warm front and the cloud and rain persist for a more prolonged period. Small depressions may appear in the warm air in advance of the main cold front giving rise to rapid falls of pressure, strong SE. winds and some rain. When the depression passes into Iran or the Persian gulf the ESE.-SSW. winds are replaced by cold winds from the NW. with the usual phenomena of the cold front, such as fall of temperature and humidity and sometimes also squalls of gale force, thunderstorms and sandstorms. At Shaibah only about 1 cold front in 3 is said to give rain. The weather improves rapidly after the passage of the cold front, becoming bright and clear. Over the sea the strong NW. winds produce swell which travels faster than the cold front and provides a useful means of forecasting the arrival of the front.

The interval between the arrival of the cold and warm fronts is from 12 to 36 hours; it is usually longer in the Persian gulf than further eastwards. Near Gwadar the disturbances tend to move along the mountains of the north-west frontier and to break up, and there is a tendency for disturbed weather to last longer in that region.

The cold front is in general inclined from north-east to south-west; its rate of advance is variable but on the average it travels from Bushire to Jask in 36 hours. On very rare occasions the front is directed from north-west to south-east so that the cold front phenomena appear over the whole region from Bushire to Karachi within 12-24 hours.

8 In the transition seasons when the tracks of western depressions have receded to more northerly latitudes their passage is sometimes accompanied by local thunderstorms and squalls in the Persian gulf; this is more likely to be the case if their arrival is in the afternoon coinciding with the period of greatest convectional activity.

2—TROPICAL CYCLONES AND EASTERN DEPRESSIONS

In the seasons before and after the monsoon, tropical cyclones originating in the Arabian sea may on rare occasions influence the weather of the Gulf of Oman, and even more rarely of the Persian gulf. In the last eighty years only 17 such storms are known to have affected the area between Karachi and the Gulf of Oman. Of these one was in April, four in May, nine in June, two in September and one in November. They gave rise to gales or strong winds, rain, squally weather, and heavy sea and swell along the Makran coast and in the Gulf of Oman. On one or two occasions, notably in April 1847 and in June 1898, the storm travelled into the Gulf of Oman with all the attendant weather of a severe tropical cyclone.

From June to September depressions which often do not reach the intensity of a tropical cyclone form in the Arabian sea, accompanying the revival of the monsoon after a period of temporary inactivity. Sometimes these depressions, after travelling north-north-west along the coast of Bombay, instead of passing over the coast of India into Gujarat move in a westerly direction to the extreme north of the Arabian sea and enter Iran or Baluchistan. It is said that marked cyclonic circulation of ground and upper winds, squally and overcast weather, occasional light passing showers, dust-storms, rough seas and heavy swell often follow the passage of these depressions into Iran. Thunderstorms are known to occur over the hills of Oman. In the Persian gulf these depressions are unlikely to give rain.

Occasionally also in July and August, and more rarely in June and September, depressions which have travelled westwards over northern India from the Bay of Bengal pass into the Arabian sea. Their effect is not often felt west of Pasni, which is 70 miles east of Gwadar, but sometimes they give rise to overcast skies, light passing showers, duststorms, rough seas and squally weather as far west as the Gulf of Oman, and possibly thunderstorms over the hilly regions of the Province of Oman, west of Muscat. Over the Persian gulf nothing is likely to occur but duststorms. Occasionally these depressions travel across India on a more northerly track, passing westwards into Iran and possibly Iraq, and in that case they may cause duststorms in the Persian gulf and on the west Makran coast but they are unlikely to give rain.

IV—WIND

1—SURFACE WINDS

Wind roses showing the mean frequencies of wind from different directions in each of the twelve months are reproduced in Figs. 4-9. The roses for the open sea, compiled from ships' observations taken at all hours of the day, show both the direction and force of the



FIG. 4—SURFACE WINDS AND SEA TEMPERATURE—MONTHLY

The figures inside the circles indicate the percentage frequency of calms. The roses for the sea areas represent observations taken at all hours of the day; the figures below the roses indicate the number of observations. The roses for the land stations are for the morning hour only; on these roses the wind force is not indicated.

The isotherms of sea surface temperature are indicated by the thick lines.

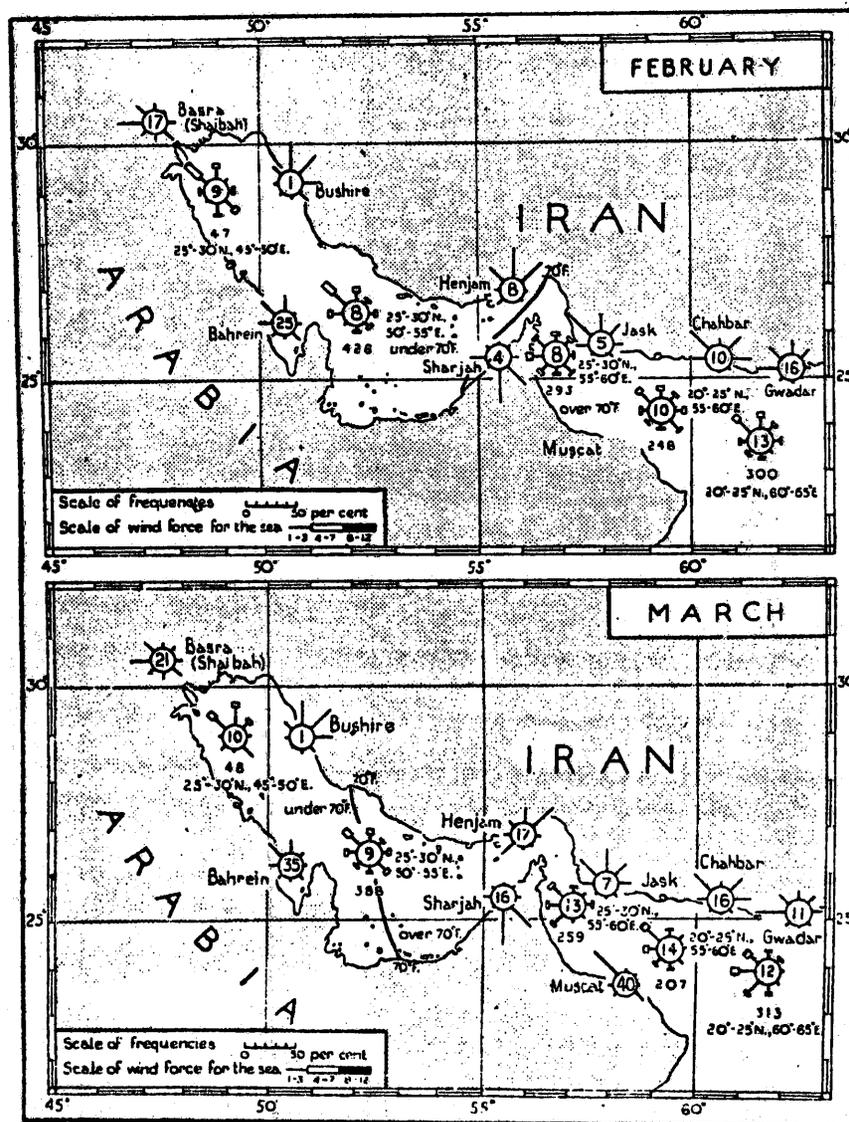


FIG. 5—SURFACE WINDS AND SEA TEMPERATURE—MONTHLY

The figures inside the circles indicate the percentage frequency of calms. The roses for the sea areas represent observations taken at all hours of the day; the figures below the roses indicate the number of observations. The roses for the land stations are for the morning hour only; on these roses the wind force is not indicated.

The isotherms of sea surface temperature are indicated by the thick lines.

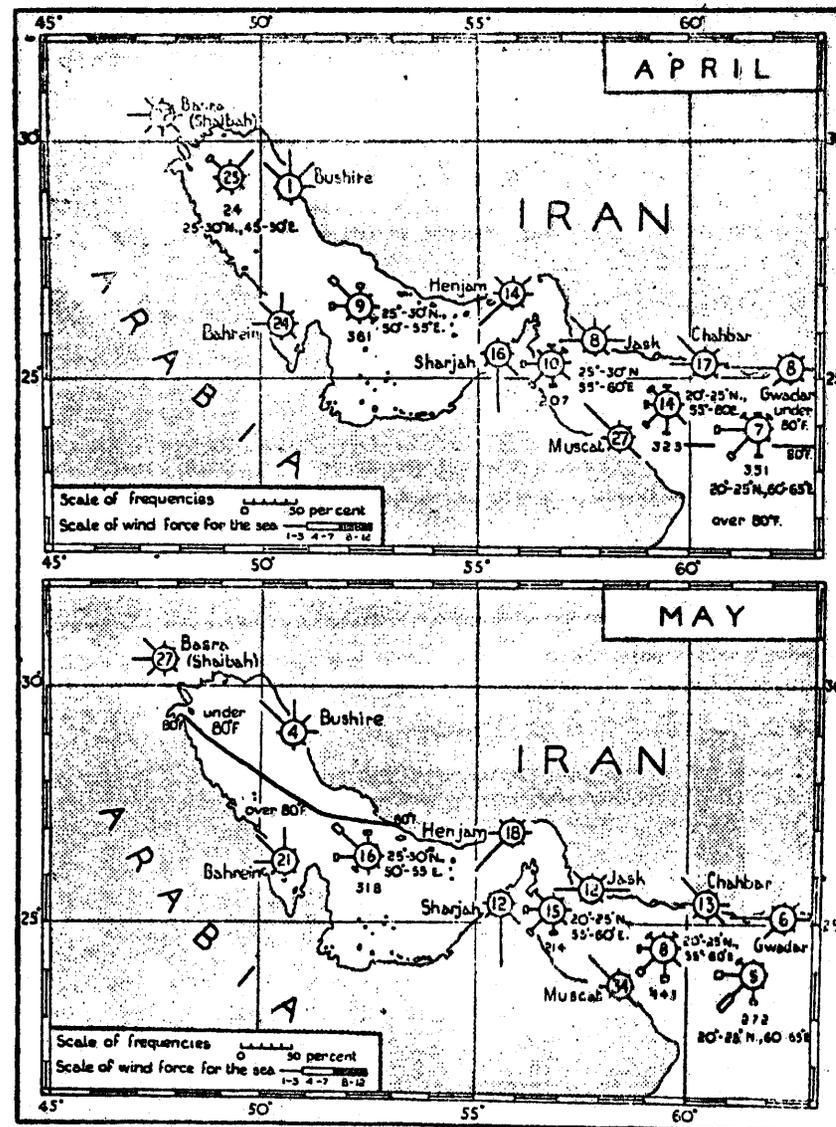


FIG. 6—SURFACE WINDS AND SEA TEMPERATURE—MONTHLY

The figures inside the circles indicate the percentage frequency of calms. The roses for the sea areas represent observations taken at all hours of the day; the figures below the roses indicate the number of observations. Owing to lack of observations no rose is shown for the area 25°-30° N., 45°-50° E. in May. The roses for the land stations are for the morning hour only; on these roses the wind force is not indicated.

The isotherms of sea surface temperature are indicated by thick lines.

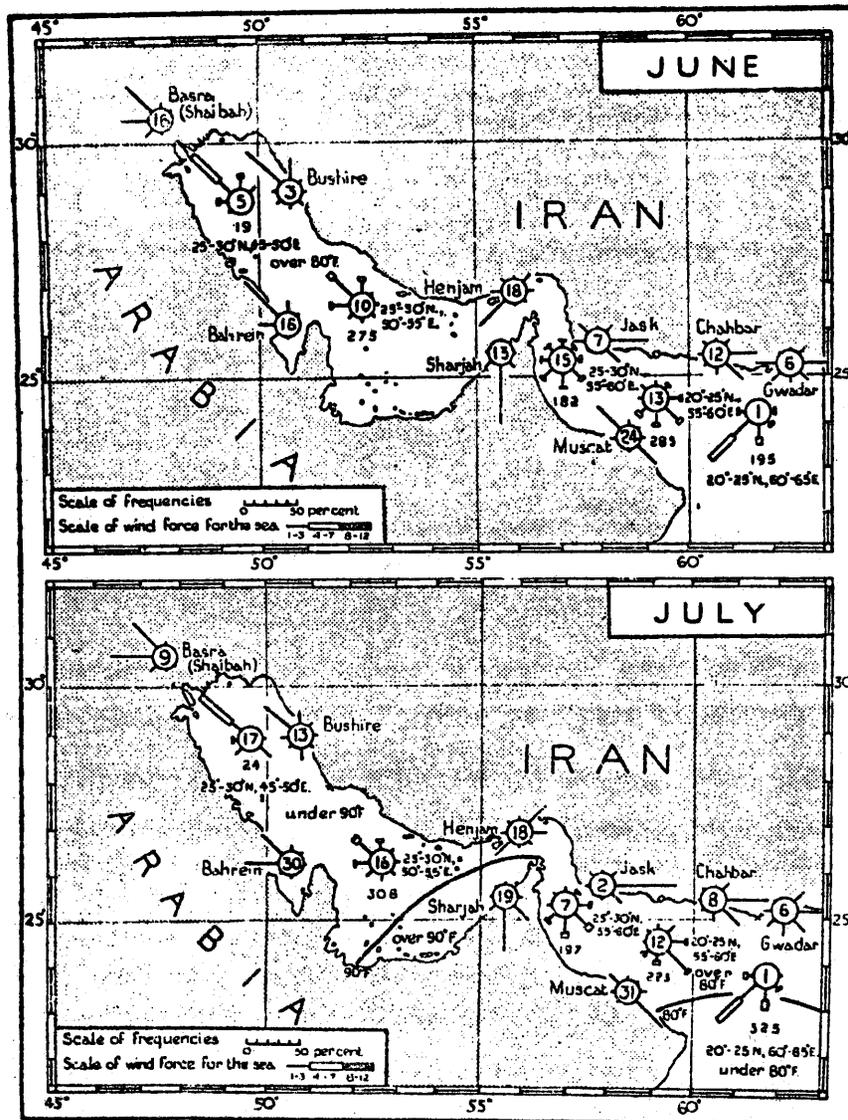


FIG. 7—SURFACE WINDS AND SEA TEMPERATURE—MONTHLY

The figures inside the circles indicate the percentage frequency of calms. The roses for the sea areas represent observations taken at all hours of the day; the figures below the roses indicate the number of observations. Note the scarcity of observations over the sea west of 50° E. The roses for the land stations are for the morning hour only; on these roses the wind force is not indicated.

The isotherms of sea surface temperature are indicated by the thick lines. No isotherms are shown for June as the temperature of the sea is between 80° and 90° F.



FIG. 8—SURFACE WINDS AND SEA TEMPERATURE—MONTHLY

The figures inside the circles indicate the percentage frequency of calms. The roses for the sea areas represent observations taken at all hours of the day; the figures below the roses indicate the number of observations. Owing to scarcity of observations no rose is shown for the area 25°-30° N., 45°-50° E. in August. The roses for the land stations are for the morning hour only; on these roses the wind force is not indicated.

The isotherms of sea surface temperature are indicated by the thick lines.

Erratum.—The rose for 25°-30° N., 50°-55° E. in August should show 3 per cent. of moderate winds from W.

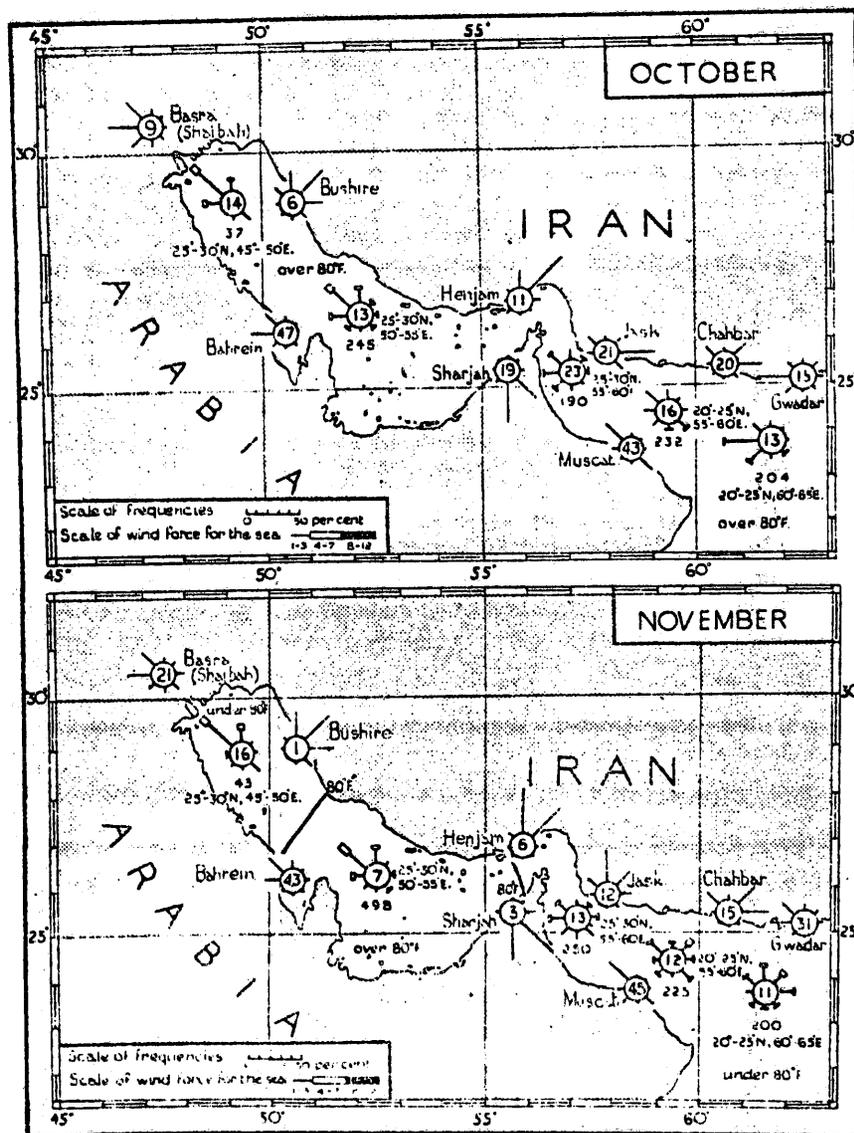


FIG. 9.—SURFACE WINDS AND SEA TEMPERATURE—MONTHLY

The figures inside the circles indicate the percentage frequency of calms. The roses for the sea areas represent observations taken at all hours of the day; the figures below the roses indicate the number of observations. The roses for the land stations are for the morning hour only; on these roses the wind force is not indicated.

The isotherms of sea surface temperature are indicated by the thick lines. No isotherms are shown for October as the temperature of the sea is between 80° and 90° F.

wind, but for places on the coast information of the direction only is available; the roses for coastal places are for the morning hour of observation, 0500 at Shaibah, and 0730 or 0800 at other places. The data on which the wind roses are based are given for the sea in Table II, and for the coast in the general climatological tables on pages 101-10. The frequencies of winds from different directions in the afternoon are also included in the general climatological tables in order to show the diurnal variation on the coast.

The percentage frequencies of winds of different forces, irrespective of direction, at both the morning and afternoon hours of observation are given in Table IV for Basra (Shaibah), Bushire, Bahrein, Sharjah, Henjam, Jask and Muscat.

A supplementary table (Table III) gives the monthly frequency of wind direction and of wind force and the mean monthly wind speed at Fao (control vessel *Alert*) at two hours of the day.

The surface winds over the Persian gulf are north-westerly for the greater part of the year, and the gulf does not share in the seasonal alternation from NE. winds in winter to SW. winds in summer which is the characteristic feature of the winds of the Indian peninsula. In the Gulf of Oman the winds are more variable, with NW. winds in winter and light SE. winds in summer; the latter are apparently due to an off-shoot of the SW. monsoon along the gulf.

Seasonal variation

Winter (December to February).—Persian gulf.—In the winter the normal pressure gradient over the Persian gulf is slight. The gulf lies between the intense high-pressure area of central Asia and the high-pressure area of the Atlantic which in mid winter extends eastward over Africa almost to the Red Sea. Owing to the comparatively high temperature of the water a shallow low-pressure is apparent over the gulf itself. In these circumstances in periods of undisturbed weather the winds are comparatively light and air flows out from the continent. Its direction is influenced by the contour of the land, especially by the high land of Iran which runs from north-west to south-east roughly parallel to the eastern shore of the gulf. Thus, over the open waters the wind tends to follow the direction of the gulf. In the north it blows chiefly from NW., though on the Arabian side it tends to be more northerly; further south the direction becomes westerly and on the west side of the Strait of Hormuz even south-westerly.

The average force of the wind in the north of the gulf is between 3 and 4 of the Beaufort scale, and in the south between 2 and 3. This, however, gives little indication of the actual force that will be experienced on any given occasion because it is the result of an alternation of the strong winds, sometimes reaching gale force, that occur in disturbed weather and the comparatively light winds of the intervening periods.

At places on the coast north-westerly winds are also frequent, but the wind is affected to a large extent by the direction of the coast-line and, especially on the Iranian side of the gulf, it tends to blow from the land towards the sea except in the afternoon when it is affected by the sea breeze. Hence in winter at Basra (Shaibah) and at Bahrein, an island off the Arabian coast, the prevailing winds in the early morning are from W. or NW., whereas at Bushire on the Iranian coast they are from between N. and E. At Henjam on the northern shore of the Strait of Hormuz they are from N. or NE. in the early morning and from SW. in the afternoon; whereas at Sharjah on the southern shore they are from SE. or S. in the morning and from W. or NW. in the afternoon.

These normal conditions are frequently interrupted by periods of disturbed weather associated with the passage eastwards of western depressions, which give rise to south-easterly winds in advance of the centre and to south-westerly and north-westerly in the rear. The effect of these depressions is felt more frequently in the northern half of the gulf than in the south.

The frequency of these south-easterly winds increases considerably in January, and in that month in the north they account for nearly 25 per cent. of the total number of observations, and in the south for between 10 and 15 per cent.

The alternation between SE. and NW. winds is the most conspicuous feature of the surface winds in winter. A fuller description of the characteristics of the winds is given in the section on local winds on page 33.

Gulf of Oman.—In this gulf during the winter the winds are in the main northerly, with NW. as the most frequent direction. Calms, however, are more frequent than in the Persian gulf and are said sometimes to last for days; the average force of the wind is between 2 and 3 of the Beaufort scale. At times the nashi or NE. wind blows very hard and is much dreaded by native seamen, as the Bātinah coast is to leeward and affords no shelter. Steady breezes are almost unknown, and seamen say that there is either too much wind in the gulf or else there is none at all.

On the Arabian coast conditions are similar; the prevailing wind is from NW., and there are frequent calms which at Muscat account for 40 per cent. of the observations in the early morning.

On the north coast of the gulf the wind in the early morning is nearly always from off the land. NE. winds are often strong, especially in the latter part of December and in January, and sometimes reach Beaufort force 7. They are often accompanied by clouds of dust and by gloomy squally weather, and sometimes continue for 2 or 3 days with lulls in the afternoon, freshening again at night. These NE. winds are very frequent in the early morning and at that time of day southerly winds are rare on the coast; in the afternoon a light sea breeze springs up and the wind blows most frequently

from between south and west. Like the Persian gulf, though to a less extent, the Gulf of Oman is affected by western depressions, and sometimes a secondary to one of these depressions forms in the neighbourhood of the Strait of Hormuz and moves along the line of the mountains of the north-west frontier, giving rise to disturbed weather. Strong squally winds from between NE. and SE., accompanied by rain, are not infrequent in December and January, and NW. winds, or shamals, occur at times, though they are less frequent than in the Persian gulf; they are sometimes vigorous and one strong shamal is said usually to occur in February.

Spring (March to May).—In general March belongs to the winter regime, April is a month of transition and in May summer conditions begin to set in.

Persian gulf.—In the southern part of the gulf bad weather is said to be over by the middle of March, and in the north by the middle of April.

Over the open sea the south-easterly winds associated with western depressions decrease very rapidly from March onwards and by May they have practically disappeared. At the same time the north-westerly winds increase in frequency, and in the north by the end of May the wind begins to blow persistently from that quarter; in the Strait of Hormuz the prevailing direction is SW.

In March the average force of the wind is between 2 and 3 of the Beaufort scale, but in April and May it is less than 2 in some parts and reaches its lowest value for the year.

Land and sea breezes continue to be evident on the coasts, and though the land breeze is weaker than in winter the sea breeze is stronger.

Gulf of Oman.—The winds are very variable in spring but in general over the open sea there is a decrease in the north-westerly and an increase in the south-westerly winds, until by May south-westerly winds predominate.

On the north coast of the gulf the most noteworthy change in the spring is the rapid decrease of the north-easterly off-shore winds which are so characteristic of the cold season. By May these NE. winds are of very rare occurrence even in the early morning and are practically non-existent in the afternoon. Light or moderate sea breezes from SW. set in during the day and veer to WNW. or NW. at night; at the eastern end of the gulf these sea breezes decrease in frequency with the increasing cloud amount which marks the onset of the summer monsoon.

At Muscat on the Arabian coast the prevailing wind in the early morning continues to blow from NW. as in the winter, but there is a slight increase in the frequency of winds from SE. In April and May the winds in this region may on very rare occasions be affected by the passage of tropical cyclones coming from the Arabian sea.

Summer (June to August).—In summer a vast low-pressure area develops over north-west India and extends its influence westward over Iran to Arabia and even to the eastern Mediterranean giving a fairly steep gradient for north-westerly winds over the whole of that area. These north-west winds extend southwards to the southern end of the Persian gulf; over the Gulf of Oman the winds are much more variable, they blow mainly from the SE. and are apparently a deflection of part of the main current of the SW. monsoon. The winds in the two gulfs apparently belong to two quite distinct circulations; the dividing line between the two lies somewhere in the neighbourhood of the Strait of Hormuz, where the hot north-westerly winds of the Persian gulf appear to rise above the cooler winds of the SW. monsoon.

Persian gulf.—Over the open waters of the gulf and also at places on the coast winds from between W. and N. blow persistently throughout the summer months, and from the beginning of June until mid July, during the 40-day shamal (see page 34), they are said to be rarely interrupted; they do much to moderate the heat at the head of the gulf during the early part of the summer.

In June and July the average force of the wind as deduced from ships' observations is only about 3 of the Beaufort scale, and it moderates to less than 2 in the latter part of the summer. There is a marked decrease of speed between July and August. The force is subject to considerable variation, and when pressure falls over north-west India the NW. winds over the Persian gulf gradually strengthen; they are frequently strong and occasionally, though very rarely, reach gale force. These NW. winds are often laden with sand.

At the south-eastern end of the gulf the wind blows from between W. and SW. In the neighbourhood of Lingeh the prevailing winds are from W. whereas at Henjam they are chiefly from SW. during the latter part of the day. The increase in frequency of easterly winds in the Strait of Hormuz in the latter half of the summer is well marked. At Henjam in August winds from between NE. and SE. account for nearly 70 per cent. of the observations in the morning and for about half that number in the afternoon.

Gulf of Oman.—In summer the winds in this gulf are quite distinct from those over the Persian gulf. In June NW. and N. winds are still comparatively frequent, but in July and August the shamal is hardly felt and the prevailing winds are from SE.

The SW. monsoon wind which blows strongly over the Arabian sea during the summer months is not felt as a SW. wind westward of Ras al Hadd, but part of the main current is deflected to blow from the SE. These SE. winds are very frequent east of a line joining Ras al Hadd and Cape Jask but to the west of that line the winds are more variable, and although the SE. winds penetrate further into the Gulf of Oman as the SW. monsoon reaches its greatest

strength, the influence of the monsoon is never felt west of a line drawn between Bandar Abbas and the Musandam peninsula, except occasionally as a slight swell coming in from the Gulf of Oman. Any south-easterly winds that are experienced in that region have the characteristics of the kaus (see page 40). The average force of the wind is between 2 and 3 of the Beaufort scale.

On the northern shores of the Gulf of Oman the winds in the early morning are from the east, they veer during the day and by early evening they blow from some direction between SE. and SW. Winds from N. and NW. are very rare on this coast in the summer, especially in the eastern part, but occasionally very hot, dry, north-westerly winds lasting not more than a day have been experienced in the Gulf of Oman.

In June before the monsoon becomes fully established over the Arabian sea, tropical cyclones occasionally form on the northern boundary of the advancing SW. winds and these storms have been known to reach the Gulf of Oman and the Makran coast giving rise to heavy gales, the direction of which depends upon the position of the centre. Particulars of these storms are given on page 17.

Autumn (September to November).—Persian gulf.—The winds over the gulf during this season continue to be mainly from the NW. as in the summer months, but they become somewhat less persistent and in the north the south-easterly winds associated with western depressions begin to make their appearance as the season advances. The average force of the wind is between 2 and 3 of the Beaufort scale. The weather in the latter half of October and in November is said to be very treacherous and severe squalls may occur. A very severe squall called locally "Uhaimir." is said to occur some time between the middle of October and the last week in November; particulars are given on page 45.

Land and sea breezes are well marked, especially in the southern half of the gulf in November.

Gulf of Oman.—The SW. monsoon usually ends over the Arabian sea at the beginning of September, and between September and October the frequency of SE. winds in the Gulf of Oman gradually decreases and that of the NW. winds increases.

In September this region has on rare occasions been affected by storms from the Arabian sea which are liable to occur at the time when the SW. monsoon begins to recede.

On the coast the winds are for the most part light and variable with frequent calms in the early morning. By November the N. and NE. winds from the land have increased very much in frequency.

The average force of the wind is between 1 and 2 of the Beaufort scale.

Land and sea breezes

In the Persian gulf land and sea breezes may be felt in all seasons of the year, whereas on the Makran coast their effect is hardly noticeable between April and September.

The breezes are most strongly developed during periods of settled weather and in seasons when the prevailing winds are light. Thus, in the Persian gulf they are conspicuous in winter during the periods of comparatively light wind which intervene between the passage of western disturbances; in the summer they are masked by the prevailing north-westerly wind, but whenever this NW. wind weakens they become prominent.

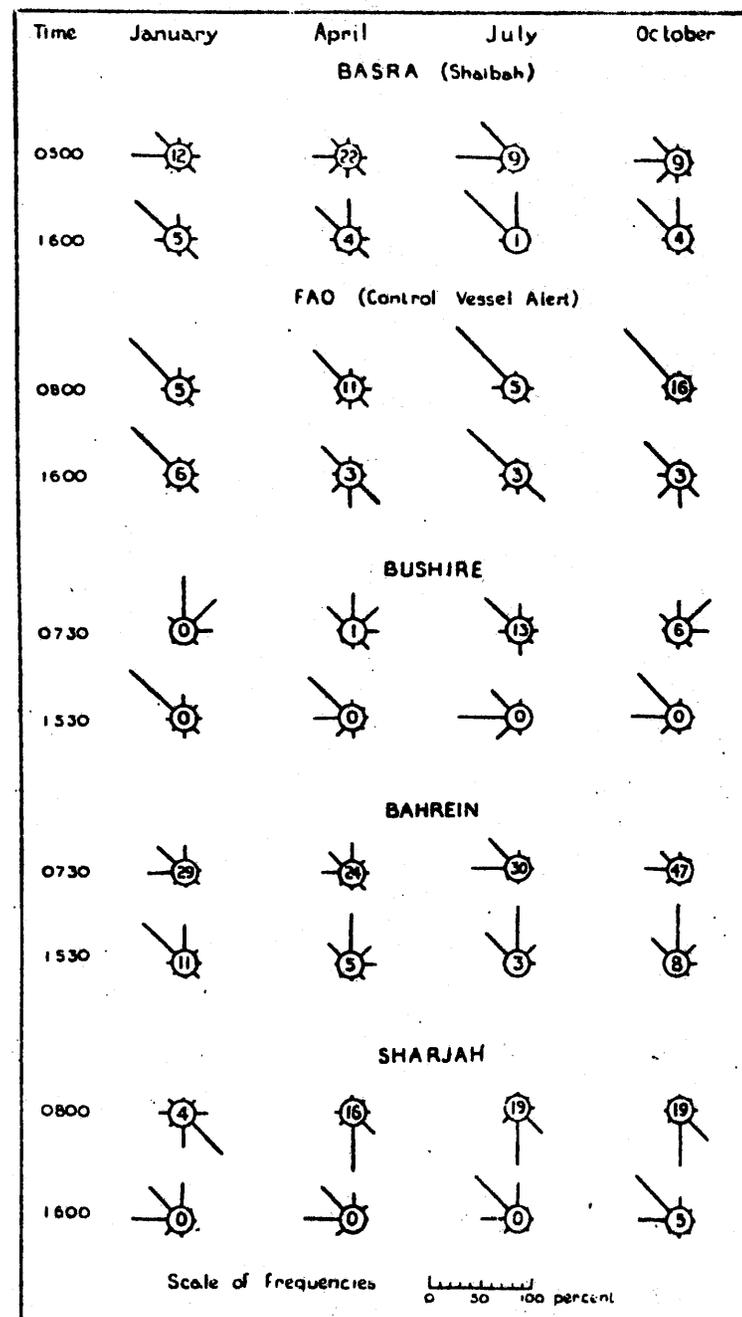
The effect of land and sea breezes on the direction of the wind is illustrated in Figs. 10 and 11, which give wind roses for the morning and afternoon hours of observation at nine stations on the shores of the Persian gulf and Gulf of Oman. The wind roses are drawn for a representative month in each of the four seasons. The corresponding data for all months of the year are given in the general climatological tables, and for Fao in Table III.

The direction of the land and sea breezes at any place depends on the trend of the coast-line, and their effect is to superimpose on the prevailing wind a component from the direction of the land at night and in the early morning, and from the direction of the sea in the afternoon. Thus, for example, at Bushire on the eastern shore of the gulf in most seasons the wind in the early morning is from slightly east of north and in the afternoon from NW. or W.; at Sharjah on the west of the Musandam peninsula the wind in the early morning is from SE. or S. and in the afternoon from between W. and N., and on the Makran coast the wind is for the most part from a northerly direction in the morning and from a southerly in the afternoon. In considering the direction of land and sea breezes the character of the prevailing wind should always be borne in mind, if that wind is strong the effect of the diurnal breezes will be shown only as a slight change in the direction of the prevailing wind and not as a complete reversal.

It is said that both land and sea breezes tend to veer gradually after their first onset.

Land and sea breezes give rise also to a diurnal variation in speed. The speed usually increases to a maximum at about 1400 and decreases suddenly after sunset, sometimes increasing later to a slight breeze which may persist throughout the greater part of the night. This diurnal variation is only apparent when the winds are light; in winter when the weather is disturbed by the passage of depressions it is very often completely masked.

The effect of land and sea breezes varies very much from place to place, but in general the land breeze is experienced only close inshore, it probably seldom extends more than 10 miles out to sea and sometimes considerably less. During fine settled weather the wind



15

FIG. 10—SURFACE WINDS—MORNING AND AFTERNOON
 Figures inside the circles indicate the percentage frequency of calms. The standards of time used differ from local time by less than 20 minutes.

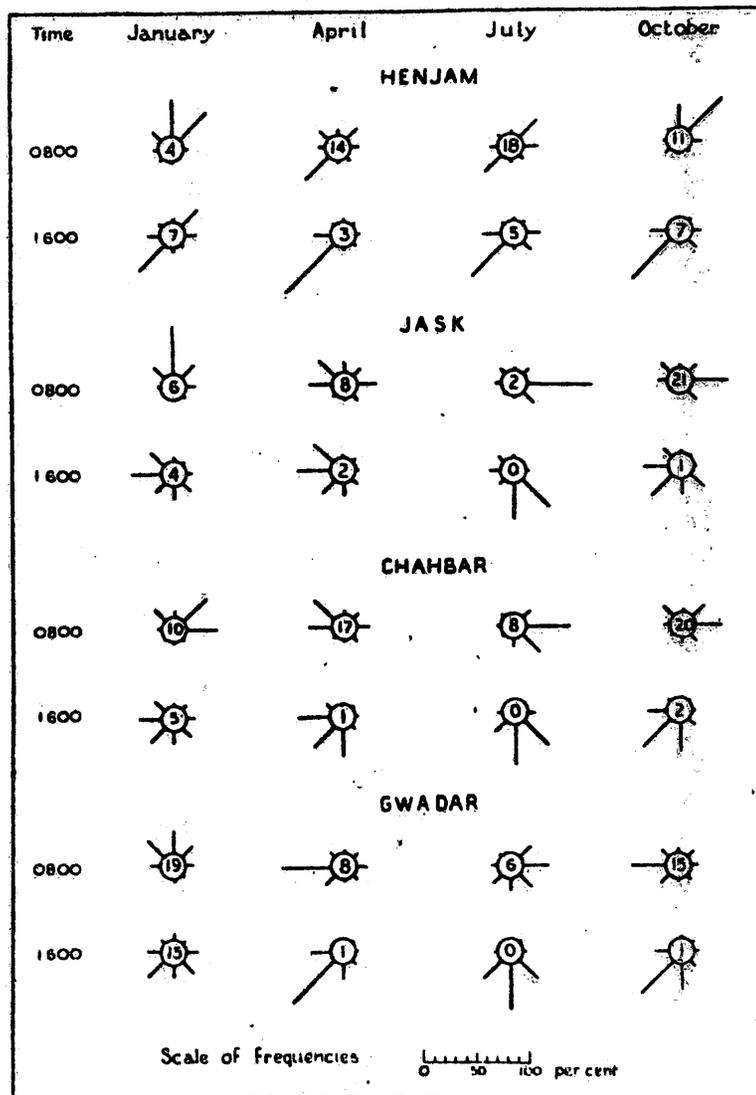


FIG. 11—SURFACE WINDS—MORNING AND AFTERNOON

Figures inside the circles indicate the percentage frequency of calms. The standards of time used differ from local time by less than 10 minutes.

usually falls calm about sunset and the land breeze freshens towards midnight and dies away at sunrise; the land breeze is usually most pronounced in the cold season from October to February and in places where the land rises steeply near the coast. At Basidu ($26^{\circ} 39' N.$, $55^{\circ} 16' E.$) there is a strong land breeze which persists until 1000 local time. On the Makran coast the land breeze is said to be often fresh or strong in November, December and January, after which it is weak and uncertain; both there and on the Arabian coast it is sometimes felt in spring as a hot wind blowing in gusts from the land.

Sea breezes occur in the Persian gulf throughout the year, and they are strongest in April and May. The time of onset of the sea breeze varies with the locality, in some places it does not set in until about midday or after, whereas near Bushire ($29^{\circ} 00' N.$, $50^{\circ} 50' E.$) when there is no shamal it may be felt as early as 0900 local time; it usually attains its maximum strength between 1500 and 1700 local time and it does much to mitigate the excessive heat of the afternoon. At Basidu sea breezes are regular, but do not set in as early as at Bushire.

Information for places for which more details are available is given below:—

At Shaibah, the aerodrome near Basrah some 60 miles from the open sea, definite evidence of a sea breeze is found on some occasions, mostly in the months March, April, May, October and November. It sets in from a south-easterly point, generally in the late afternoon, although it may be as early as 1330 or as late as 1800 local time, and it is usually a steady wind blowing with a mean speed of about 8 to 10 knots. The sea breeze is superimposed on the wind which happens to be blowing at its onset, and whether the onset of the sea breeze produces a sudden and marked change in the wind or not depends mainly on the wind conditions prevailing at the time. In summer if there is a predisposition for a SE. wind the speed tends to increase suddenly by 8–12 knots in the afternoon usually accompanied by a rise of relative humidity which may amount to as much as 10 or 15 per cent. There is also a change in the wind structure from a sluggish long-period gustiness to one of quicker period and somewhat reduced range. The conditions favourable for the development of this sea breeze at Shaibah are a gradient for SE. winds or for light variable winds and a strong temperature gradient probably of 20° or $25^{\circ} F.$ between the water temperature of the gulf and the screen temperature at Shaibah.

In the vicinity of the control vessel *Alert*, about 10 miles south-east of Fao, the effect of land and sea breezes is said to be considerable except in June when the shamal is sufficiently strong to be little affected as to direction. In the other months there is a well-marked increase in the frequency of SE. and S. winds in the afternoon, and a corresponding decrease in the frequency of winds from W., NW., and N. At Kuwait ($29^{\circ} 20' N.$, $48^{\circ} 00' E.$) the sea

breezes are regular in fine weather and blow from E. or SE.; at Bushire they are very regular in summer whereas the land breezes are light and of short duration. At Doha (25° 17' N., 51° 33' E.) there is often a land breeze in the morning, but it does not extend far from the coast. At Basidu both land and sea breezes are regular and the land breeze, as already mentioned, is strong. At Bandar Abbas (27° 09' N., 56° 19' E.) sea breezes are fairly regular in summer and do much to mitigate the heat.

Diurnal variation of wind speed.—At Shaibah when NW. winds are blowing there is usually a diurnal variation in the speed. Both the speed and gustiness increase soon after sunrise and towards midday reach a maximum, which is maintained for several hours. Subsequently the wind decreases and becomes light during the night. South-easterly winds do not show such a regular tendency to fall off in speed at night. During the months from April to October, on days when the wind is very light and fluctuating during the morning, it quite often happens that a steady wind from a northerly point sets in sometime between midday and 1700 local time and lasts until a little after sunset, when it falls light and indefinite. Its onset is generally fairly sudden, but its mean speed seldom exceeds about 8 knots. This wind may be partly due to the effect of the extensive body of water of Hammar Lake, which lies to the north-west of Shaibah.

There is also a diurnal variation in the direction of the wind; the northerly or north-westerly winds back gradually during the night, the northerly winds tending to become north-westerly or west-north-westerly and the north-westerly winds westerly.

Local winds

In the Persian gulf as in the Mediterranean most of the characteristic winds have acquired local names, hence NE. winds are known locally as Nashi, E. or SE. winds as Kaus or Sharki, SW. winds as Suhaili and NW. winds as Shamal. Of these the most important on account both of its frequency and of the phenomena which accompany it is the NW. wind or shamal.

Shamal or NW. wind is the prevailing wind of the Persian gulf and blows for about nine months in the year. It is much less frequent in the Gulf of Oman and in that region it is rare in summer. The term shamal is applied locally to any north-westerly wind, though among Europeans it is sometimes restricted to exceptionally strong winds from that direction.

NW. winds are more frequent in the north of the Persian gulf than in the south; in the north they are the prevailing winds from February to October and are comparatively frequent also in winter. Their direction follows the trend of the coast and the effect of land and sea breezes is shown by the fact that the wind blows more from the land by night and from the sea by day. Thus the direction of the shamal varies somewhat from place to place, and though the

average direction is NW. the name is applied in some parts to winds whose direction locally is W. or even SW. For example, according to the Persian Gulf Pilot, on Qishm island "the coast is open to the shamal which in this locality blows from between SW. and WSW."

On the Arabian coast of the Persian gulf, the average direction of the shamal is from N. to NNW., and on the west coast of the Musandam peninsula WNW., shifting to SW. near the entrance of the gulf. On the Iranian coast, its direction is NW. at the head of the gulf, altering to WNW. and W. along the coast and to SW. at the entrance of the gulf.

The shamal has not the same characteristics in all seasons. In summer the term sometimes refers simply to the NW. winds of the warm season which are prevalent for some nine months of the year and which reach their greatest strength at about mid summer during the so-called 40-day shamal. On the other hand the same term may be used also to refer to infrequent periods of 3-7 days during which the NW. wind strengthens gradually to perhaps as much as Beaufort force 7 and then dies away.

In winter the shamal is of a squally type and is associated with the cold fronts in the rear of western depressions, it has much more violent characteristics than the summer shamal and is of shorter duration.

The shamal during the summer months.—In the midsummer months the NW. winds are rarely interrupted in the Persian Gulf, in fact the period, June 6 to July 16, known as Bārihal-Jauzah or Bārih al-Kabir, is often called the 40-day shamal or great shamal because during that period the NW. winds are strong and continuous.

These persistent NW. winds of the summer months vary somewhat in force owing to fluctuations in the intensity of the seasonal low-pressure area over north-west India; when the low pressure deepens the shamal may become strong, and blow perhaps with Beaufort force 7, sometimes for a week at a time, though usually only for about 3 days; the wind seldom exceeds force 7 though it may occasionally reach gale force. The wind force usually increases gradually and then decreases gradually when the seasonal low-pressure area returns to the normal, in striking contrast with the squally shamals of the winter.

During the periods in summer when the shamal is strong it is often gusty and laden with sand and dust from the desert which reduces the visibility, but it is rarely associated with thunderstorms or sudden squalls; the air is very dry and the sky usually cloudless. At Shaibah the shamal is hot and dry. On the Shatt al 'Arab the dust is at times so thick that neither bank is visible from the middle of the river, which is about a mile wide at its mouth and about $\frac{1}{2}$ mile wide between Basra and Abadan.

The shamal during the winter months.—In the winter months strong shamals are associated with the passage of western depressions and they usually show certain characteristic features. They occur

with the passage of the cold front of a western disturbance, and not infrequently set in as a sudden squall which sometimes reaches Beaufort force 8 and occasionally even more for short periods, with a rapid veer of wind from some southerly direction to NW.; they are generally accompanied by the usual phenomena of a line-squall, namely a rapid rise of pressure, fall of temperature, thunder and rain. The change in the wind may be almost instantaneous; records at Shaibah indicate that the speed may increase by more than 25 knots and the direction vary through 180° in less than 5 minutes.

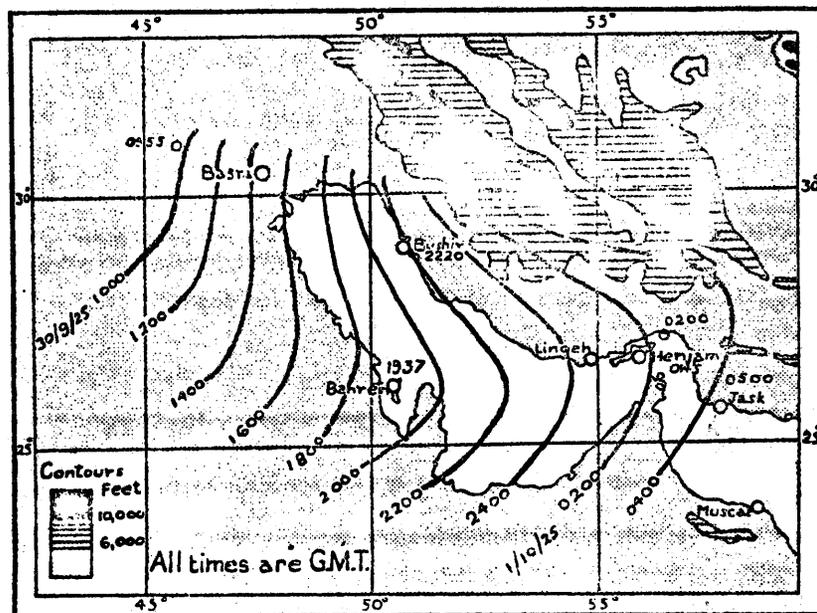


FIG. 12—PASSAGE OF A COLD FRONT DOWN THE PERSIAN GULF SEPT. 30 TO OCT. 1, 1925

(Reproduced from a paper by B. N. Banerji, in *Beiträge zur Physik der freien Atmosphäre*, Leipzig, Band 19, 1932, page 34)

The time of occurrence of these squally shamals is dependent on the progress of the western depression, and it may reach a particular place at any time during the day or night. It is said that shamal-squalls usually reach Jask 24 to 48 hours after they leave the head of the Persian gulf, and if they persist beyond that point they may take a further 24 to 36 hours from there to Karachi. On some occasions, however, the passage of the cold front is much more rapid. Fig. 12 shows the passage of a cold front down the Persian gulf at two hourly intervals from 1000 on September 30 to 0400 on October 1, 1925; on that occasion the cold front passed from Shaibah to Jask in 15 hours.

The direction of the shamal-squalls is NW. in the western half of the Persian gulf, becoming W. further east as the front takes a

more north to south direction. In the western part of the Strait of Hormuz the shamal-squall may even blow from SW.

The worst weather occurs at the onset or shortly after the arrival of the NW. wind and later the weather becomes dry and cool with good visibility. At Shaibah these NW. winds are said to be cool and invigorating and to be a sign of the setting-in of more settled weather.

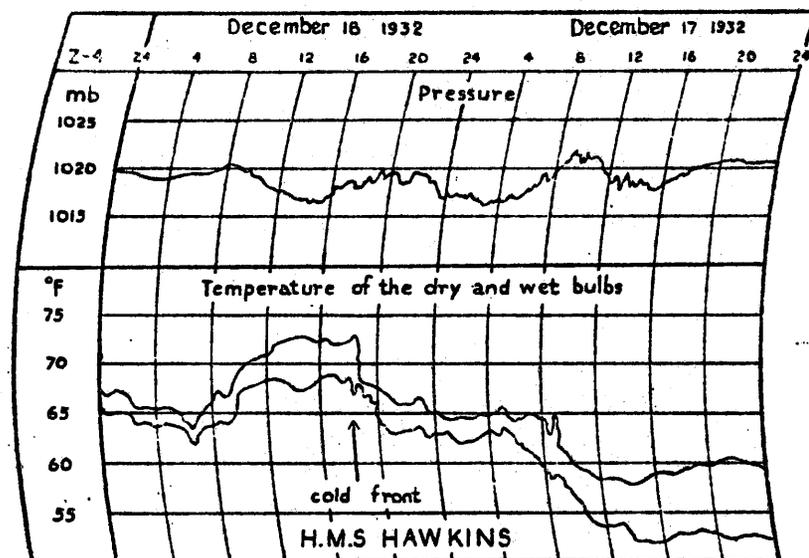


FIG. 13—BAROGRAM AND DISTANT-READING THERMOGRAMS DURING A SHAMAL

The barograph is recording 3-4 mb. higher than the corrected barometer reading.

These squally shamals provide one of the most striking examples of bad weather over the Persian gulf, and in view of their sudden onset the forecasting of their arrival is a matter of considerable importance. They are sometimes but not always preceded by the customary signs of an approaching depression, namely, a fall of pressure for a day or two before their arrival, a rise of temperature with winds between SE. and SW. and cloud changing gradually from high to low. This indication from clouds, though satisfactory on the whole on shore, is said to be rather unsatisfactory at sea when there is usually not much cloud before the arrival of the cold front. In the southern part of the gulf, the most useful indication of the approach of one of these squalls is the arrival of a heavy swell created by the strong winds. The front affects the extreme northern end of the Persian gulf first, and the heavy swell begins there and travels south-eastwards or eastwards along the gulf; it travels very much faster than the squall and arrives in advance of the squall front.

Some of the severest winter shamals often spring up in fine weather, and are heralded by a thick cloud bank which rolls down and veils everything in haze, though these phenomena sometimes occur without a storm following.

In view of their outstanding importance descriptions of three shamals experienced by ships in the Persian gulf are quoted here.

The first account is of a shamal experienced by H.M.S. *Hawkins* when on passage from Sharjah to Bahrein on December 16 and 17, 1932. It is a good example of a typical winter shamal.

The traces of the barograph and the distant-reading thermograph are reproduced in Fig. 13. The records show the passage of the cold front very clearly, and also illustrate the fact that in these cases the barometer cannot be relied upon to give any adequate warning of the approach of bad weather.

The account has been compiled from the information given in the meteorological log kept in H.M.S. *Hawkins*. The times quoted throughout are Z-4; the ship retarded her clocks 37 minutes at 1945 but the necessary adjustment to the times has been made to allow for the alteration.

The ship left Sharjah (25° 22' N., 55° 24' E.) for Bahrein (26° 12' N., 50° 30' E.) at 0900 on December 16, 1932. The wind at 0830 was ESE., Beaufort force 2, or about 4 knots; the barometer reading was 1017.2 mb.; the sky was overcast, less than one tenth of the sky being covered with low cloud at about 3,000 feet; the visibility was very good.

At 1045 the wind veered to SE., force 2, and continued to veer until 1730 when it was S. by E., still force 2. At 1230 a general cirrus haze was observed over the sky and at 1400 this was accompanied by very high altocumulus and altostratus clouds which were increasing to the west and decreasing to the east. The visibility was very good being between 20 and 30 miles until 1800, after which it deteriorated to between 7 and 12 miles, probably owing to rain.

At 1600 detached cumulus clouds were observed to the west and another layer was seen to the north-east. The altostratus clouds in the west were seen to be getting lower and becoming stratus. At this time it became very dark and threatening to the westward and the altostratus in that quarter was in horizontal ribs. Some towering cumulonimbus was just visible on the horizon to the west and north-west.

The barometer had been steadily falling since 0900, and at 1600 had fallen to 1013.4 mb., but this fall of 3.8 mb. was probably due mostly to the regular diurnal variation which would give a fall of pressure between those hours of about 3 mb. The wind was reported to be freshening and the clouds were getting lower; up to 1600 the sky had been overcast but only about 1 to 2 tenths was low cloud. At 1730 the sky became 7 tenths covered with low cloud and at 1745 some spots of rain fell. The wind at this time veered to SW. and continued to freshen, it was logged as Beaufort force 4.

At 1825 the wind veered suddenly to NW. and increased to gale force, the maximum speed being 40 knots; it was estimated that the cold front passed at this time as the temperature of the air at 1800 was 72.5° F. and at 1900 was 68.2° F., the sky at this time was completely overcast with low clouds and heavy rain was falling. At 1900 the ship reported that the wind was NW. force 9, and a gale warning was broadcast to all ships. The rain evidently eased up at 2037 as only some spots of rain were reported as falling at that time, but at 2057 a heavy shower, lasting for 10 minutes, was reported.

The wind eased to force 7 by 2037, but was still blowing from NW., at 2137 it was logged as NW. by N. force 6, after which it appears to have moderated very rapidly to force 2 to 3, a short shower occurring at 2157. The wind then eased up to force 2 from 2237 until 0037, but the weather was squally at 2311 and it was raining hard from then until 2352. The wind direction remained NW. by N. until 0307.

Between 0037 and 0137 the wind was increasing and was logged as force 3 until 0237 but no rain was falling. At 0247 light rain fell for about 10 minutes. At 0307 the wind backed to W. by S. and remained in that direction until 0437; the wind force increased to 4. From 0437 to 0537 the wind began to veer gradually to NW. by W. and it remained in that direction until the ship arrived at Bahrein at 0837, the wind force, however, increased to between 4 and 5 at 0537 and at 0637 it was force 7 (about 28 knots) and remained at that strength.

The temperature of the air at midnight was 65.9° F. and showed little change until 0837, when it was 65° F. The weather was reported as squally with intermittent rain at 0622 and the clouds, which had been as low as 1,000 feet, did not begin to lift until 0837.

No swell was reported in the meteorological log before the arrival of the shamal, the first entry under swell was at 1900 when the direction was north-west, and this north-westerly swell continued for the remainder of the time.

No thunder or lightning was reported by the ship during the passing of the shamal.

The second account is of a shamal experienced by H.M.S. *Norfolk* between April 14 and 18, 1939, at Bahrein and whilst on passage from that place to Bandar Shapur (30° 27' N., 49° 05' E.). April is in the transition season and the shamal described has some characteristics of both the winter and summer types. It was probably associated with a western depression because the *India Weather Review* refers to the existence of such a depression at that time, but it is noteworthy that there is no reference in the account to the occurrence of southerly winds before the onset of the gale.

During the night of April 12-13, before reaching Bahrein, the barograph recorded an unusually steady fall through 5 or 6 mb. The next morning the fall was checked and the barometer appeared to be rising, showing the normal diurnal variation. The weather at Bahrein that morning was fine and cloudless with light north-westerly winds at the surface; strong NW. winds were experienced at 8,000 feet by the ship's aircraft.

Early the same afternoon the wind freshened and became a moderate breeze, still from the NW., then it strengthened still further and by the late afternoon reached moderate gale force with a sea that rendered it necessary for all boats to be hoisted. The sky became clear except for patches of rapidly moving detached cumulus; towards Bahrein considerable sand haze was noticeable.

The wind continued at moderate gale force throughout the night, moderated the following morning, and continued as a strong NW. wind for two days. It dropped considerably on the night of the 15th and 16th but strengthened the following day. The ship left Bahrein for Bandar Shapur on the 17th, and at sea on the 17th and 18th the shamal continued as a moderate to fresh NW. breeze with moderate NW. swell and rough seas.

At Bandar Shapur sheltered waters were reached, where the shamal appeared to have died down.

A noticeable feature of the shamal was the very cool conditions which accompanied it. Temperature dropped from 80° to 70° F. in the first afternoon and remained at this reading throughout the shamal.

There appeared to be no local prognostications foretelling the shamal as several native fishing boats, taken unawares outside the harbour on the first afternoon, were capsized and their crews rescued only with great difficulty by the ship's boats.

The third account, also from H.M.S. *Norfolk*, describes a shamal experienced on November 19, 1938, when the ship was at Khör Kuwai (26° 22' N., 56° 22' E.).

This shamal cannot be said to have possessed the true characteristics of a cold-front squall. The weather preceding it was cloudless and not appreciably warmer or more humid than that which followed. The sudden drop of temperature was that usual with a thunderstorm, while no sudden change of wind occurred until after the passage of the squall when the wind dropped and later backed to SSW.

The weather during the forenoon at Khör Kuwai was fine with a clear sky, except for large cumulus over the mainland, and light north-westerly winds.

At 1430 a striated cirrus mass, typically associated with cumulonimbus, was observed spreading rapidly from the north-west in the direction of Jezirat al Ghanam island; by 1600 it covered 7 tenths of the sky and heavy cumulonimbus was visible over the hills of the island to the north-west.

The barograph trace had flattened out slightly at 1500 and at 1600 it showed a small sudden rise. At the same time (1600) the wind, which had continued light north-westerly, dropped and there followed immediately a sudden squall and a strong wind (force 6) which lasted about fifteen minutes and then dropped. A little later there was a particularly heavy squall which touched gale force and continued as a strong wind for about half-an-hour, still from NW.

Slight rain fell during the second blow, but a sailing boat returning from outside the anchorage reported a heavy rainstorm on the other side of the island.

At 1750 the wind dropped again, then backed to SSW, freshened slightly, and became variable. The cloud to the north-west had by now broken up into altostratus and altocumulus, total 6 to 7 tenths. A swell became noticeable in the channel.

At 1830 the wind was light from due south, and the cloud amount had fallen to 4 tenths altocumulus to the north-west; by 2100 the wind had dropped and the sky was almost clear. During the night it was calm with skies 3 to 4 tenths covered. A light NW breeze set in the following morning.

Nashi is the Arabic name for a NE. wind. These winds occur in the winter on the Iranian coast of the Persian gulf, especially near the entrance to the gulf, and also on the Makran coast. They are probably associated with an outflow from the central Asiatic anticyclone which extends over the high land of Iran. They appear to be similar in character to the bora of the Mediterranean, but are not so severe.

The nashi is gusty with frequent lulls. It often persists for about 3 to 5 days but frequently lasts only one day; if it lasts for 3 days it is said that it will be strongest on the third day.

The type of weather usually associated with a nashi is dull, cloudy and rainy; the air will often be thick with dust before its arrival, but if it lasts for more than one day the air will become clearer after the first day, owing possibly to rain over the land.

The barometer is not, as a rule, affected by a nashi, being usually high, but it sometimes falls a little when the wind is over.

These NE. winds sometimes become more intense over lower Iran during the approach of a western depression and produce secondary local disturbances with the oncoming south-easterlies of the depression. In these circumstances they are accompanied by cloudy weather and, as a rule, also by rain especially over the hilly regions. For example, in the Henjam-Lingeh region, north-easterly winds with cloud and rain may be associated with the approach of a western depression near Bushire.

On the Makran coast strong NE. winds are frequent in December and January, accompanied by clouds of dust and often by gloomy, squally weather; they last sometimes 2 or 3 days, easing up in the afternoon and freshening again at night.

Kaus (Arabic) or Sharki (Persian) are the local names for south-easterly winds, but the names are sometimes applied also to easterly winds.

In the winter months from about December to April south-easterly winds usually occur in advance of depressions during the warm-front period. They are accompanied by falling pressure, damp and gloomy weather, severe squalls and sometimes by thunderstorms with considerable cloud gradually turning to drizzle and rain which may be heavy. The winds gradually strengthen and are strongest towards the end of their existence, they sometimes reach Beaufort force 7 and occasionally even rise to gale force after blowing as a moderate or fresh breeze for some 12 hours or more. The indication of the arrival of the kaus in winter is a falling barometer and cloudy, threatening weather. The wet and cloudy weather may last for a prolonged period but the wind seldom persists for more than 3 days; the strongest often last only one day.

On the whole the weather is less disturbed than that which accompanies the squally shamal which usually follows the period of southerly winds. When the wind veers to south the kaus is nearing its end and sometimes the wind veers suddenly to NW. with the arrival of the cold front. If, however, the centre of the depression lies far to the north the SE. winds may die away without producing any exceptionally bad weather.

It should be borne in mind that a vessel that has sheltered from the kaus in an anchorage open to the shamal should weigh immediately the kaus is over or she may have to ride out a shamal on a lee shore.

At Shaibah, near Basra, the kaus is said to be hated by all because during the hot weather it engenders prickly heat and in winter foreshadows rain.

In the summer months winds from the south-east occur near the entrance to the Persian gulf and over the western part of the Makran coast, this being the transition region between the SW.

monsoon of the Arabian sea and the NW. winds of the Persian gulf. These SE. winds are an offshoot of the main SW. monsoon and they are in consequence usually damp and are accompanied occasionally by considerable cloud.

Suhaili is the Arabic name for a south-westerly wind. These winds occur only in winter and only infrequently extend over the whole gulf.

They sometimes follow a kaus and are preceded by masses of cloud rising from the south. They generally last only a few hours and are accompanied by rain and thunderstorms.

The suhaili is much feared by the inhabitants of the Persian gulf as it blows into nearly all the otherwise sheltered anchorages on the Iranian coast.

Gales, strong winds and squalls

Winds of gale force (Beaufort force 8 or more) lasting for several hours are comparatively rare; but squalls during which the wind exceeds force 8 for short periods of time are not infrequent. Winds of force 8 or more appear to be most frequent in winter whereas winds of force 6 or more seem to occur most often in early summer. In winter, gales are associated almost entirely with the passage of western depressions. The wind may rise to gale force both during the southerly winds of the warm sector or with the NW. winds in the rear of these depressions. In the former case the wind is said to increase gradually in strength to gale force, whereas the NW. gales may set in suddenly with the passage of the cold front and are squally.

In the transition seasons of spring and autumn gales are comparatively rare in the Persian gulf though a shamal occasionally reaches gale force. Squalls, however, are by no means uncommon, and in the autumn they may be severe (see page 45). In the Gulf of Oman gales have been recorded on a few rare occasions when tropical cyclones from the Arabian sea travel northwards to the gulf; on these occasions the wind may even reach hurricane force. At Muscat for example on June 5, 1890, the wind is said to have blown with hurricane force for 24 hours beginning from NE., backing to N. and W. and finishing from SE.

In summer gales are rare; those that do occur in the Persian gulf are from NW. or N., and are probably due to a deepening of the seasonal low pressure over north-west India. Gales of this type are not likely to set in suddenly.

Gales and strong winds over the sea.—The percentage frequency of gales, compiled from ships' observations taken over a long period of years, is shown in the wind roses of Figs. 4-9 on pages 18-23 and in the columns headed III of Table II, pages 111-2.

Observations at the head of the Persian gulf, west of the meridian of 50° E., are insufficient to give reliable information but there are enough to show that gales are rare. Of the 450 observations available for the year as a whole only one recorded a gale, and that was from SE. in January.

Further east between the meridians of 50° and 55° E. records are more numerous. In December and January, the months when gales are most frequent, they have been reported on between one and two per cent. of the occasions when observations were made. They may blow from any direction between SE. and N. but none has been recorded from NE. or E. In no other month is the frequency of gales greater than one per cent. Gales have been recorded in all the spring months, their direction in that season being between SW. and N.; in summer, gales have been recorded in July but their direction is limited to between NW. and N.

In the Gulf of Oman and the Strait of Hormuz, north of 25° N., only gales from W. and NW. have been recorded, and these only in the first three months of the year and in November; in no month is their frequency greater than 0.6 per cent.

In the Gulf of Oman, south of Lat. 25° N., gales are infrequent, and have been recorded only in the transition months of November, March and May. Of 200 observations in March two gave gales from NW. and one from NNW.; of a similar number in November one gale was recorded from NNE.; of 443 observations in May only one gave a gale and that was from SW.

Winds of Beaufort force 7 are much more frequent; the following table gives their percentage frequency in each of the twelve months in seven different regions. The latitude and longitude of the centre of each area is given.

The number of observations in the different areas is small and varies considerably, in some months it is only 15 and in others exceeds 100 so not much reliance can be placed upon the details.

Persian gulf and Gulf of Oman—PERCENTAGE FREQUENCY OF WINDS OF BEAUFORT FORCE 7 AND OVER

Lat.	Long.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
N.	E.												
29°	50°	4	4	2	1	—	—	2	1	9	—	2	—
26½°	51°	6	17	—	—	—	—	—	—	3	—	4	—
27°	52°	11	11	10	—	—	3	—	—	—	—	—	—
26½°	54°	9	—	2	—	—	3	—	—	—	—	—	6
26½°	56°	—	5	2	—	—	—	—	—	—	—	—	11
26½°	57°	—	2	3	—	—	—	—	—	—	—	—	—
24°	59°	—	12	2	—	—	—	—	—	—	—	—	—

Authority.—Bibliography No. 13.

The figures show that strong winds of force 7 or more are most frequent in the months from December to March; and are rare

in April, May, August and October. In the winter months strong winds have been recorded from all directions, but in the summer they are limited to directions between W. and N.

Gales and strong winds over the land.—Information of the frequency of gales on the coasts is very scanty, but such evidence as there is shows that winds of force 8 or more are not likely to be prolonged. Their frequency at the morning and afternoon hours of observation, expressed as a percentage of the total number of observations, is given in Table IV in the columns headed III. The table shows that gales are most frequent in the early months of the year.

At Shaibah, near Basra, during the period of 10 years, 1928–37 only 7 gales of Beaufort force 8 were recorded, 2 in January, 2 in February and 3 in March. Observations were made at 0500, 0900 and 1600 (Z-3), and on no occasion was a gale recorded at two consecutive observations. The direction in all cases was from the SE. quadrant. The highest hourly wind recorded was 37 knots.

The average number of days and hours in each month when the instantaneous speed of the wind exceeded gale force, i.e. 33 knots, is given in the following table:—

Basra (Shaibah).—AVERAGE NUMBER OF DAYS AND HOURS WITH GUSTS OF GALE FORCE

Period: Jan. 1934–Aug. 1940

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
days	3	4	5	5	5	9	8	6	3	2	3	3	56
hours	10	15	17	13	9	40	31	19	12	2	5	4	177

Authority.—Bibliography No. 42.

The highest speed attained in a gust was 65 knots on May 14, 1936.

On the control vessel *Alert*, 10 miles south-east of Fao, in a period of 7 years, no gales were recorded. There were only 6 observations of winds of force 7, all between December and May, and they showed no preference for any special direction. There were, on the average, 41 days on which the wind rose to force 5 on at least one of the 6 observations in the day; the frequency was greatest in February, March and June with 5 or 6 days each, and least from August to October with 2 days a month or less; in the remaining months the average was 3 or 4 days. From June to October winds of force 5 or more were limited entirely to the directions NW. and N.; from November to May they were recorded from all directions but were most frequent from SE. and NW.

The only other information with regard to the frequency of strong winds on the coasts is based on 2 or 3 years' data only, and refers to winds of force 6. It is contained in the following table:—

AVERAGE NUMBER OF DAYS WITH WINDS OF
BEAUFORT FORCE 6

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Bushire	3	4	2	4	3	9	7	2	2	1	2	2	41
Bahrein	2	4	3	2	4	13	12	4	4	4	4	4	60
Lingeh	1	2	2	3	3	3	2	1	1	1	1	1	21
Heujam	2	1	2	2	2	5	2	1	1	1	1	2	22
Jask	3	4	4	2	3	5	6	4	4	2	2	2	41
Muscat	4	1	2	1	2	1	1	1	0	0	0	2	15
Chabba	0	1	1	1	2	2	3	1	1	0	1	2	15
Gwadar	1	1	3	1	3	2	1	1	0	1	1	2	17

Authority.—Bibliography No. 9.

The table shows clearly the much greater frequency of winds of force 6 in summer than in the other seasons, especially in the Persian gulf. Autumn is the quietest time of the year.

Squalls.—Squalls are a characteristic feature of the weather of the Persian gulf, and are the most serious menace to navigation that is likely to be experienced. They have been recorded in all seasons of the year.

Besides the occasional squalls associated with the cold fronts of western disturbances in the cold season that have already been referred to, squally weather is experienced from May to July and particularly in June. Duststorms are associated with squally weather, and a general idea of the tendency to squalliness in each month can be obtained from the table of the monthly frequency of duststorms on page 95 and from the table of the frequency of gusts of gale force at Shaibah on page 43.

The following notes describe briefly the general character of the squalls in each of the four seasons.

Winter (December to February).—Line-squalls are often associated with the arrival of the cold front of a western depression. In the north of the Persian gulf the wind usually veers very rapidly from some point between SE. and SW. to NW. accompanied by the usual line-squall phenomena. Squalls of this type have already been described on pages 16 and 35. The direction of the cold front is most frequently from NE. to SW. but it may take a more north to south direction in the southern half of the Persian gulf (see Fig. 12, page 35), hence in the south the sudden veer of the wind is likely to be less than in the north and the direction of the cold squall may be W. or even SW.

On the western part of the Makran coast heavy squalls from off the land, from between NW. and NE., with rain, are sometimes experienced. On this coast the nashi or NE. wind may be strong or squally in December and January (see page 39).

On the coast of the Gulf of Oman south-south-east of Muscat very heavy squalls descend through the Devil's gap (23° 10' N., 50° 05' E. approx.) in this season.

Spring (March to May).—Squalls are by no means uncommon in spring and early summer when sudden westerly squalls accompanied by dust are associated with evening thunderstorms. On May 16, 1923, at 2320 local time, the speed of the wind at Shaibah increased from 10 to 35 knots in about 6 minutes followed by a gust of 46 knots; the direction changed gradually from SW. to W.

At Kuwait squalls have caused damage to aircraft whilst refuelling in April, and at the head of the Persian gulf very heavy squalls from the northward may be experienced in May.

In Basidu road (c. 26° 39' N., 55° 15' E.) very violent squalls from the northward have been reported in May, and in the same month on the Makran coast they have been reported from WNW.

Summer (June to August).—Squalls associated with duststorms are frequent in the early summer but little detailed information is available.

In Basidu road squalls from south-eastward have been reported in July but are said not to be of frequent occurrence.

In the Gulf of Oman squally winds are likely to occur occasionally in the early summer in association with tropical cyclones coming from the Arabian sea.

Autumn (September to November).—Very severe squalls, known locally by the Arabs as "Uhaimir," occur in this season from the early part of October until about the end of the third week of November. During this period it is said that no Arab vessel will put to sea until a squall is over. If these squalls do not occur before November 23 then the Arabs consider that there will be none until the ordinary bad weather sets in some time in December. It does not appear that these squalls blow from any special direction. The air is said to be very clear before their arrival and an unusual degree of electrical action, such as St. Elmo's fire, is noticed.

The following description of a squall of this type is taken from a Remark Book of H.M.S. *Fowey* :—

At 0800 (Z-4) on October 13, 1932, H.M.S. *Fowey* was anchored off Sharjah (25° 23' N., 55° 23' E.), the wind was SW., Beaufort force 2, and the sky nearly cloudless. Pressure was 1011.1 mb., dry bulb 79° F., wet bulb 78° F. and sea temperature 86° F. The sea was smooth but there was a moderate short swell from WNW, which had begun about 12 hours previously.

At about 0900 cumulus clouds were seen to be piling up to the northward. These spread rapidly across to the north-west and developed into nimbus. There were a few vivid flashes of lightning before the squall broke with great suddenness and intensity at 1000, accompanied by heavy rain. The direction of the wind was NW., rising to a gale of Beaufort force 8. There was very little increase in swell, although the force of the wind caused the seas to break. After a quarter of an hour the squall ceased almost as quickly as it began, passing away to the south-east. The wind continued to blow from NW., force 3.

By 1100 the sky was practically clear and at noon the conditions prevailing were nearly the same as at 0800; wind SW. force 2, blue sky, barometer 1010.4 mb., dry bulb 81° F., wet bulb 79° F. and sea temperature 86° F.

A marked dryness of the atmosphere was noticed just before the squall broke, and there was considerable electrical disturbance. Insulators on the rigging continued to crackle for about half an hour after the squall had passed. During the squall the barometer remained steady at 1012.4 mb.

On November 19, 1938, the same ship experienced a squall while at Khôr Kuwait. A heavy roll cloud approached from westward with slight increase of the normal shamal wind and slight fall of barometer. It had the appearance of a line-squall but there was no change of wind direction. The squall was accompanied by strong westerly gusts which caused ships to drag.

In view of their importance a description taken from the *Marine Observer* 1926, of another sudden squall experienced by H.M.S. *Triad* in October 1925 when near Henjam is also given. It is interesting because it illustrates the suddenness with which such storms occur, and also because the squall was accompanied by driving sand and heavy rain.

H.M.S. *Triad* was anchored at Henjam. At 0550 (local time) on October 2, 1925, about 40 minutes before sunrise, a good deal of lightning and thunder was observed; there was no wind. At 0605 a very heavy cloud covered the sky from about north-north-west to south-south-west, reaching nearly to the zenith, and below this there appeared to be a dense cloud of sand coming up from west-south-west. After a few minutes' interval the storm broke, the wind rose in the course of a few minutes to full gale force accompanied by a dense cloud of driving sand; about 2 minutes later rain came down in a solid sheet and effectually put a stop to the sandstorm. The driving rain made it impossible to see more than 200 yards. The speed of the wind was estimated to be between about 60 and 70 knots.

After a period of calm the wind came away again from NNE. and was blowing strongly, though not so strongly as before the calm. By 1000 the wind had dropped to a fresh breeze, the sky had cleared and the storm could be seen passing away to the north-east.

The barometer gave no warning of the approach of this storm but rose from 1015 mb. to 1019 mb. immediately it burst. At 0400 the temperature was 86° F., shortly after 0600 the thermometer read 74° F. and it did not rise above 85° F. during the rest of the day.

Many pearling dhows were reported to have been lost during the storm.

2—UPPER WINDS

Observations of upper winds in the morning at heights up to 10,000 feet are available for Basra (Shaibah), Bahrein, Jask, Gwadar and Muscat. Wind roses for these places are reproduced in Figs. 14-33 and the corresponding data are given in Table V. The number of observations at Jask is very few, and the results for that station give therefore only a general indication of the normal wind frequencies.

It should be borne in mind when using the tables and diagrams that they are based on observations of pilot balloons and that these balloons can seldom be followed to great heights on occasions of cloud, haze or strong wind, and never in rain. Fortunately this

limitation is not serious in this region because the sky is usually clear; the results are therefore likely to be fairly reliable up to the limits of height shown, though the number of strong winds at the higher levels is likely to be underestimated. It must be remembered, however, that conditions of bad weather and overcast skies will not be represented in the results except at very low levels.

In order to supplement the pilot-balloon data, observations of the motion of low, medium and high cloud have been included for places at which the necessary information is available, namely Bahrein, Muscat and Gwadar, though in some months the number of occasions when there was any cloud present is very small.

Seasonal variation

Winter (December to February).—Persian gulf.—The winds at heights up to 3,000 feet in this region are chiefly NW. or N. but southerly winds from between SE. and SW., associated with the warm sectors of depressions, are fairly frequent. Occasionally the SE. winds are quite shallow though it is said that they sometimes extend as high as 10,000 feet. According to the data, these southerly winds decrease in frequency above 3,000 feet; their apparent rarity above that height, however, may be partly due to the fact that low cloud is more frequent with southerly winds than with northerly, and consequently when southerly winds are blowing the pilot balloons are lost sight of at comparatively low levels.

Above 3,000 feet the prevailing winds are westerly, between SW. and NW. Easterly winds are almost unknown. These westerly winds are sometimes very strong and may exceed 40 knots, they are part of the general westerly circumpolar circulation of middle latitudes, which is stronger and extends to more southerly latitudes in winter than in summer. These westerly winds are very persistent at 10,000 feet, so that whatever the wind may be at the surface it is probable that it will strengthen and become westerly in the upper layers. According to the observations of cloud motion at Bahrein, westerly winds extend at least up to the level of the high clouds.

Gulf of Oman and the western part of the Makran coast.—The winds in the lower layers in this region are more variable than those over the Persian gulf. At Jask ($25^{\circ} 45' N.$, $57^{\circ} 45' E.$) the few available observations indicate that at 1,700 feet SE. winds alternate with W. and NW., whilst at Gwadar ($25^{\circ} 07' N.$, $62^{\circ} 20' E.$) the winds at that height are almost entirely from some direction between W. and NE. and are for the most part light. At both places the wind gradually becomes westerly above 3,300 feet, and especially in January winds from W. and NW. are very persistent at high levels and blow strongly. The strength of the wind shows a very definite increase with increasing height. Easterly winds are very rare, if they occur at all, at 10,000 feet. At Muscat the winds are mainly westerly or north-westerly at all heights and become increasingly

BASRA (Shaibah)

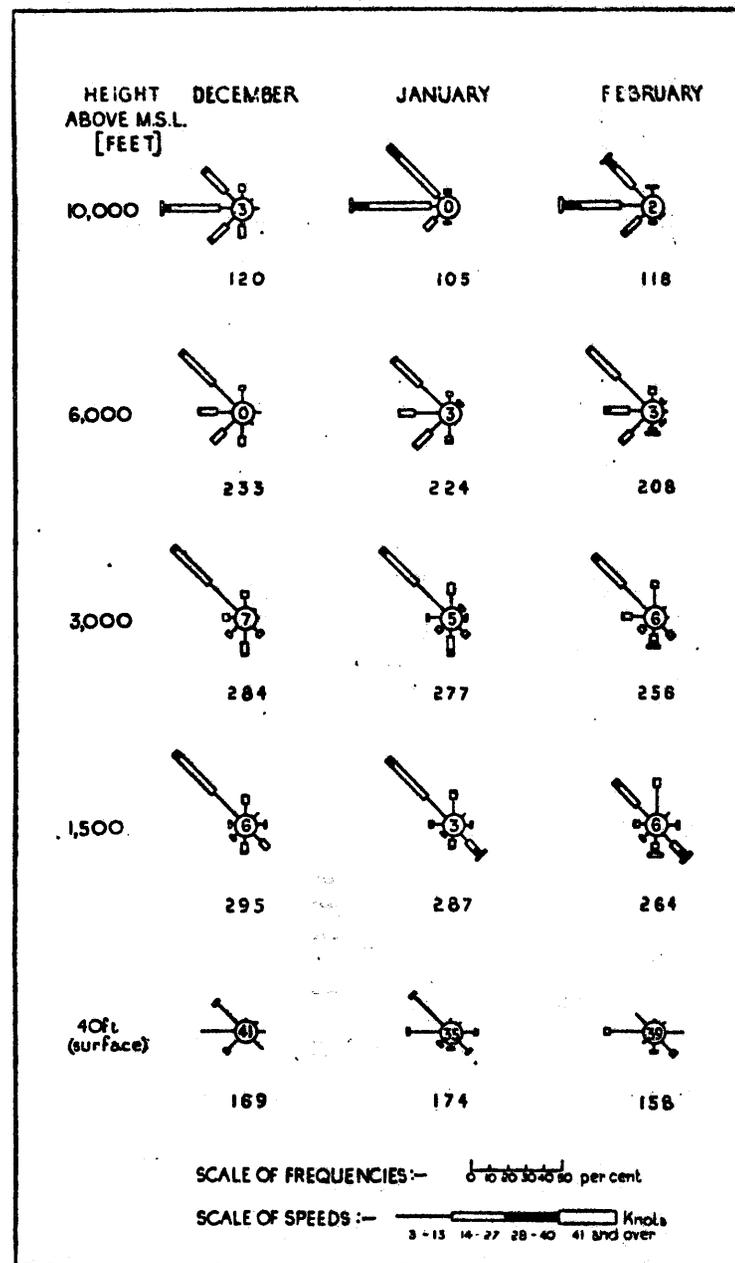


FIG. 14—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. The difference in the number of observations at 10,000 feet should be noted.

BASRA
(Shaibah)

BASRA
(Shaibah)

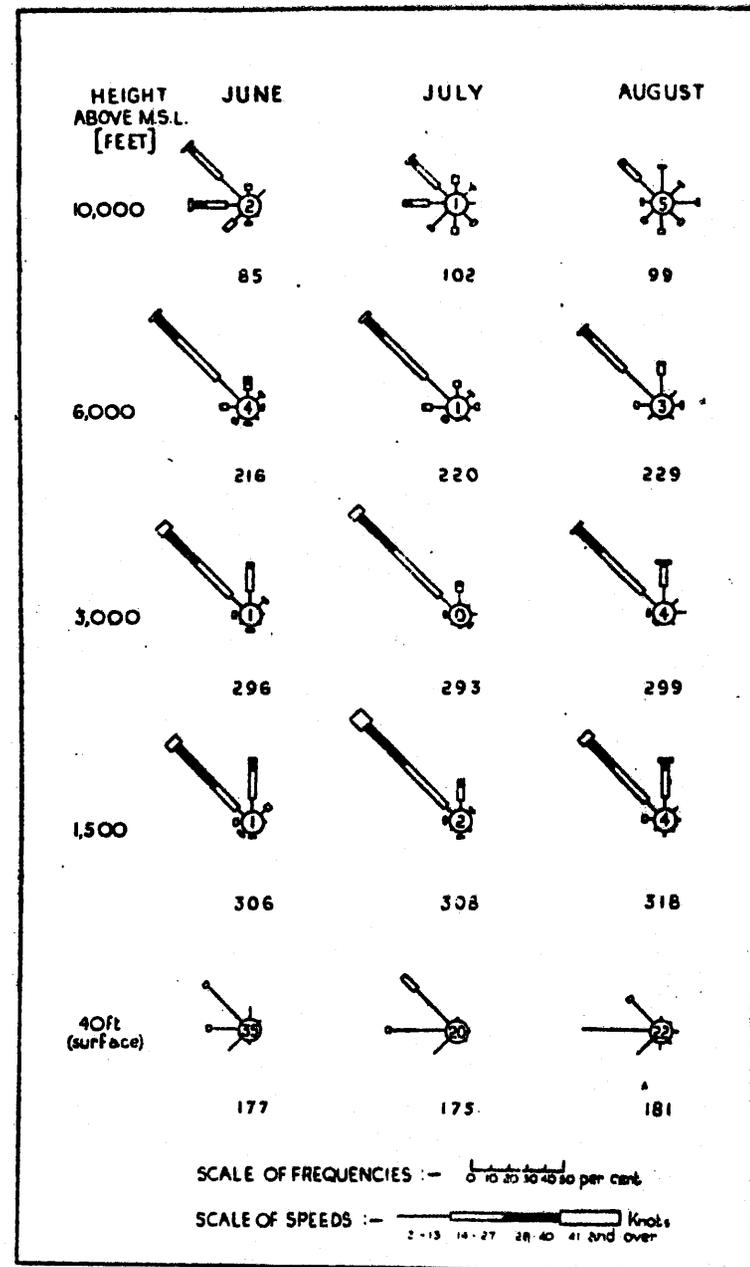
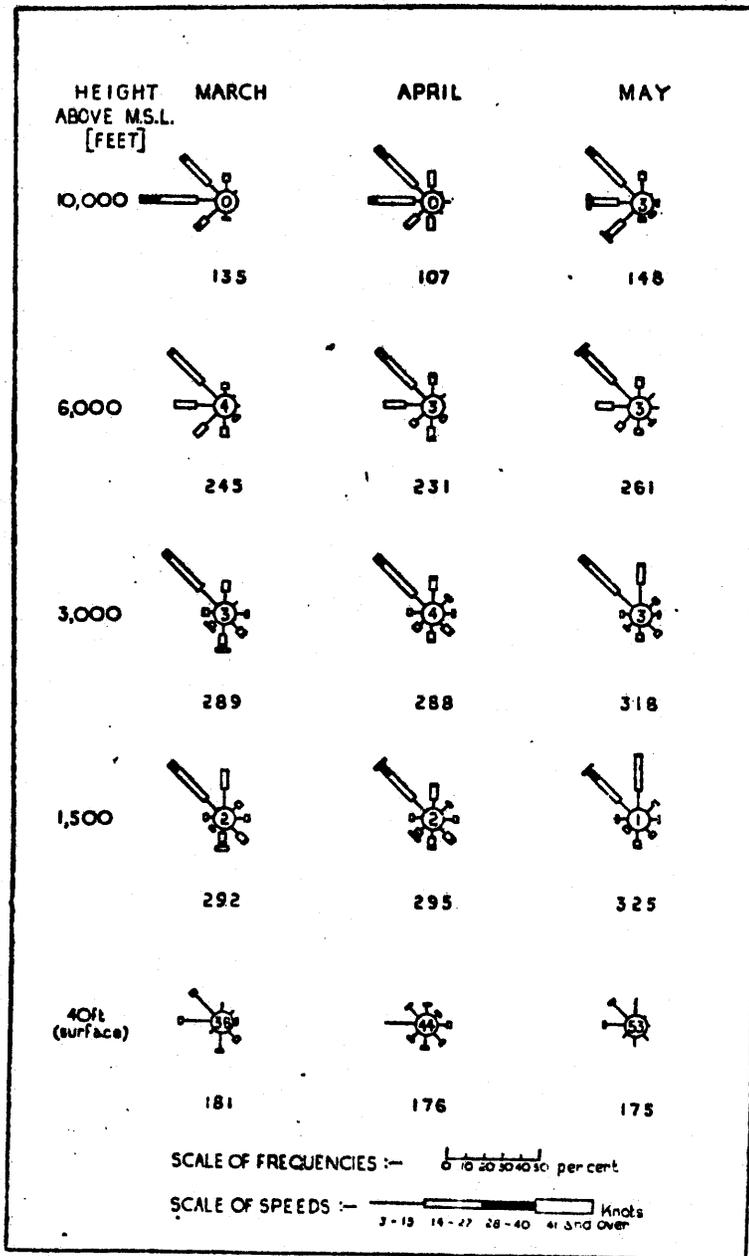


FIG. 15—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. The decrease in the number of observations at 10,000 feet should be noted.

FIG. 16—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. The decrease in the number of observations at 10,000 feet should be noted.

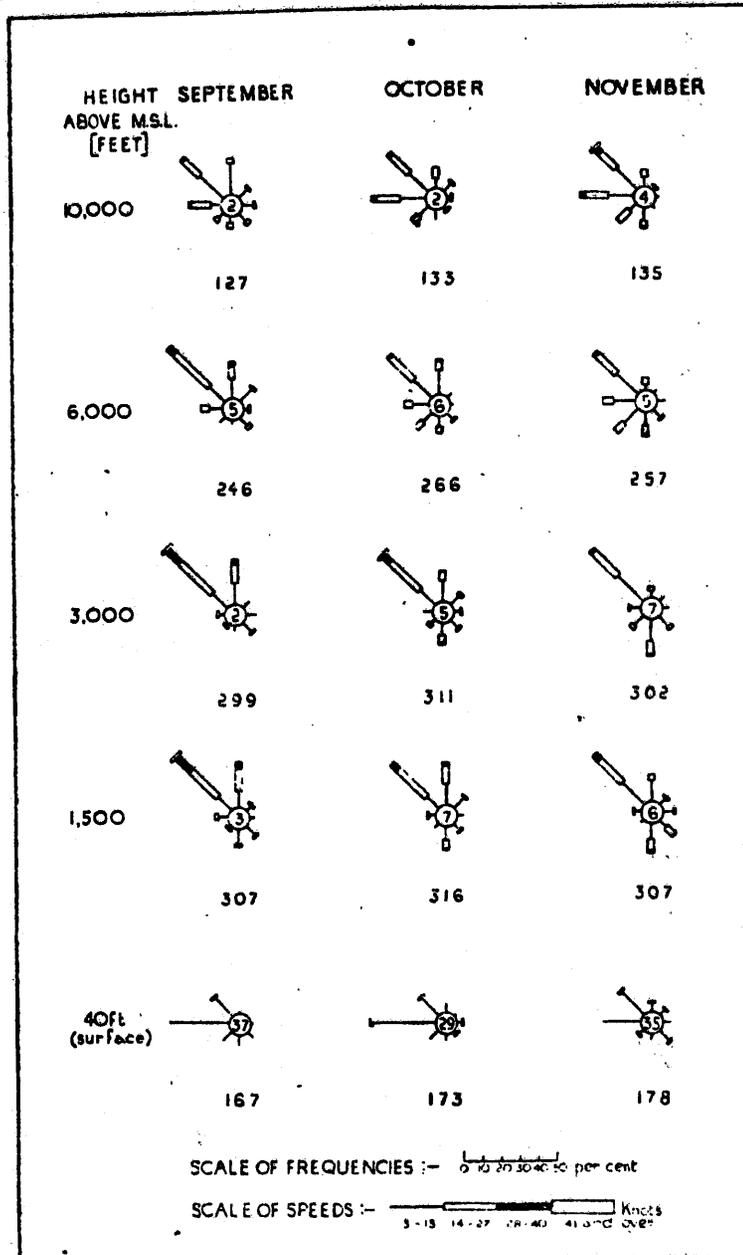
BASRA
 (Shaibah)


FIG. 17—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. The decrease in the number of observations at 10,000 feet should be noted.

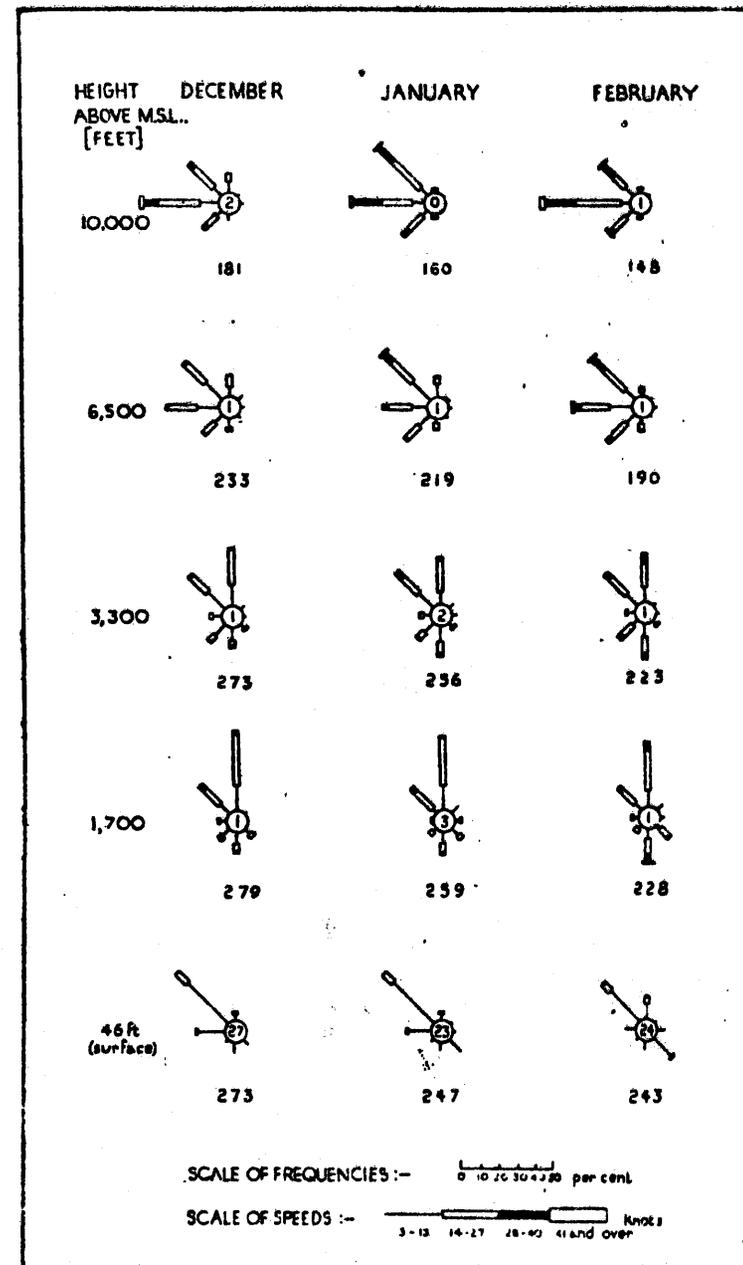
BAHREIN


FIG. 18—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

Upper winds
BAHREIN

3 53 3 54

Persian gulf and Gulf of Oman
BAHREIN

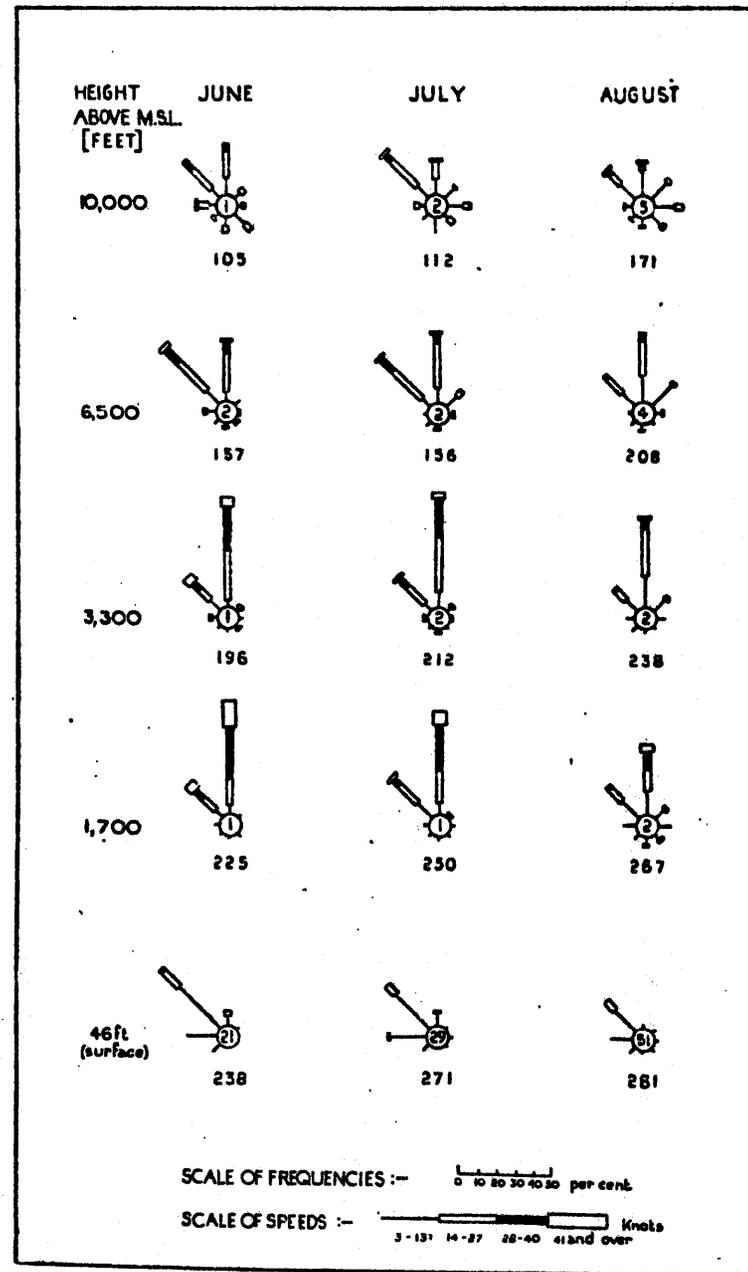
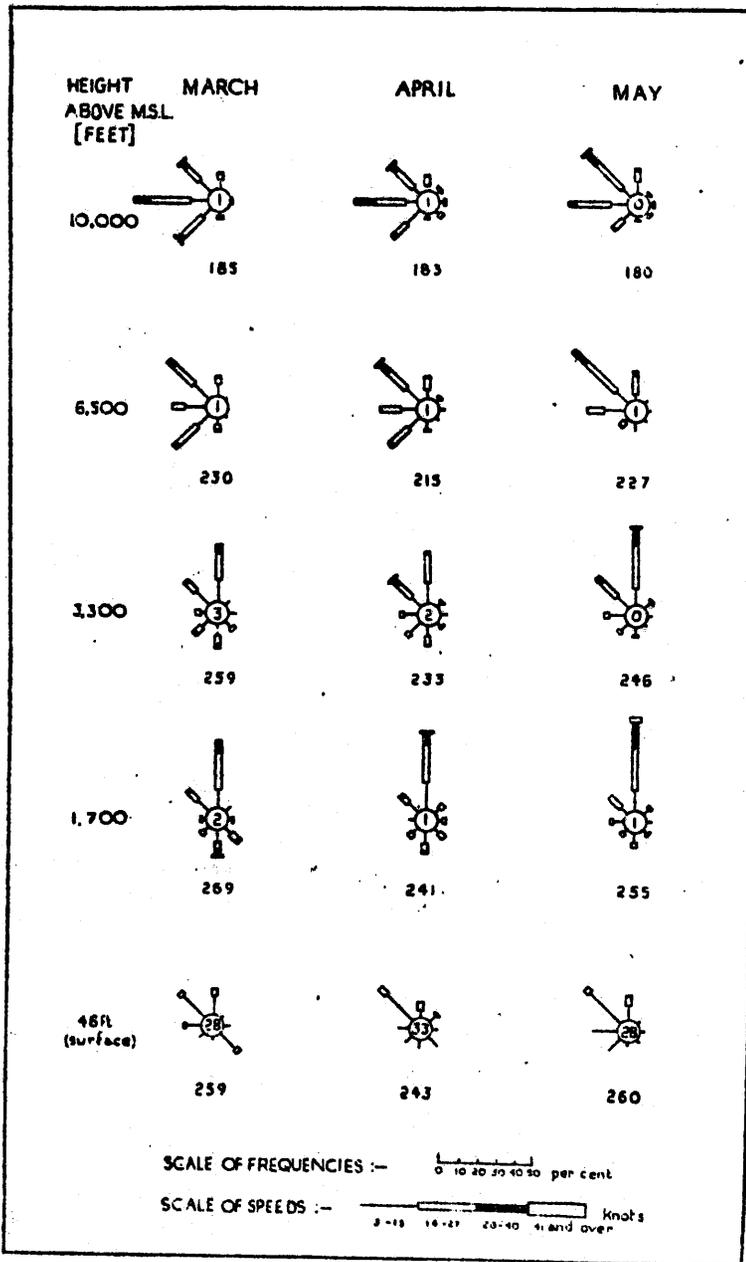


FIG. 19—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

27

FIG. 20—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

Upper winds
BAHREIN

3 55

3 56

Persian gulf and Gulf of Oman

JASK

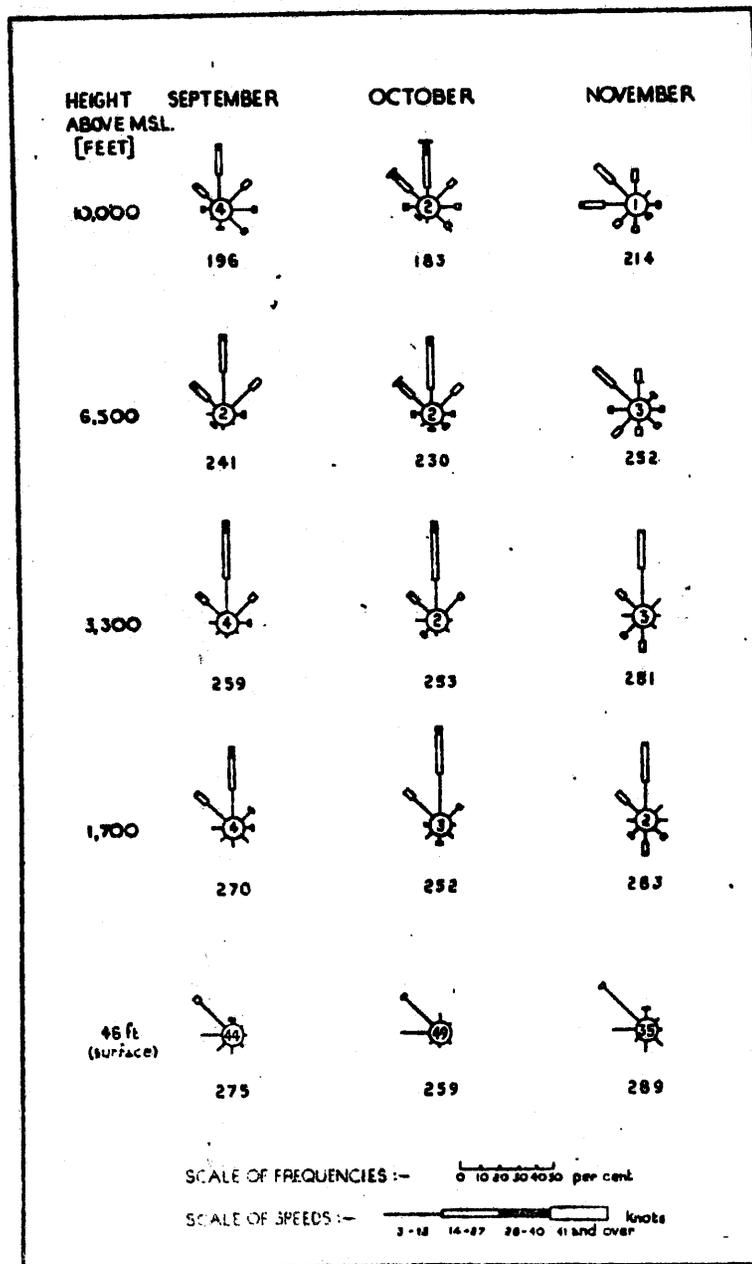


FIG. 21—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

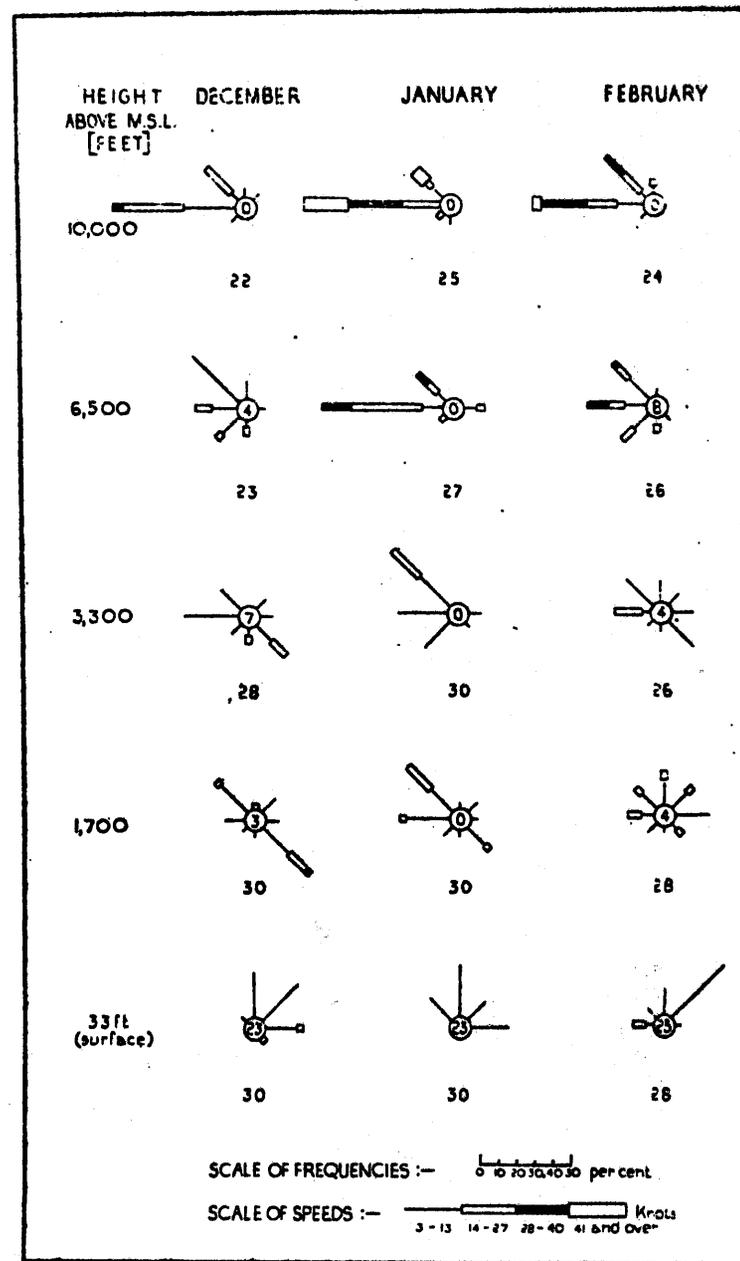


FIG. 22—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. Note the scarcity of observations at all heights.

JASK

JASK

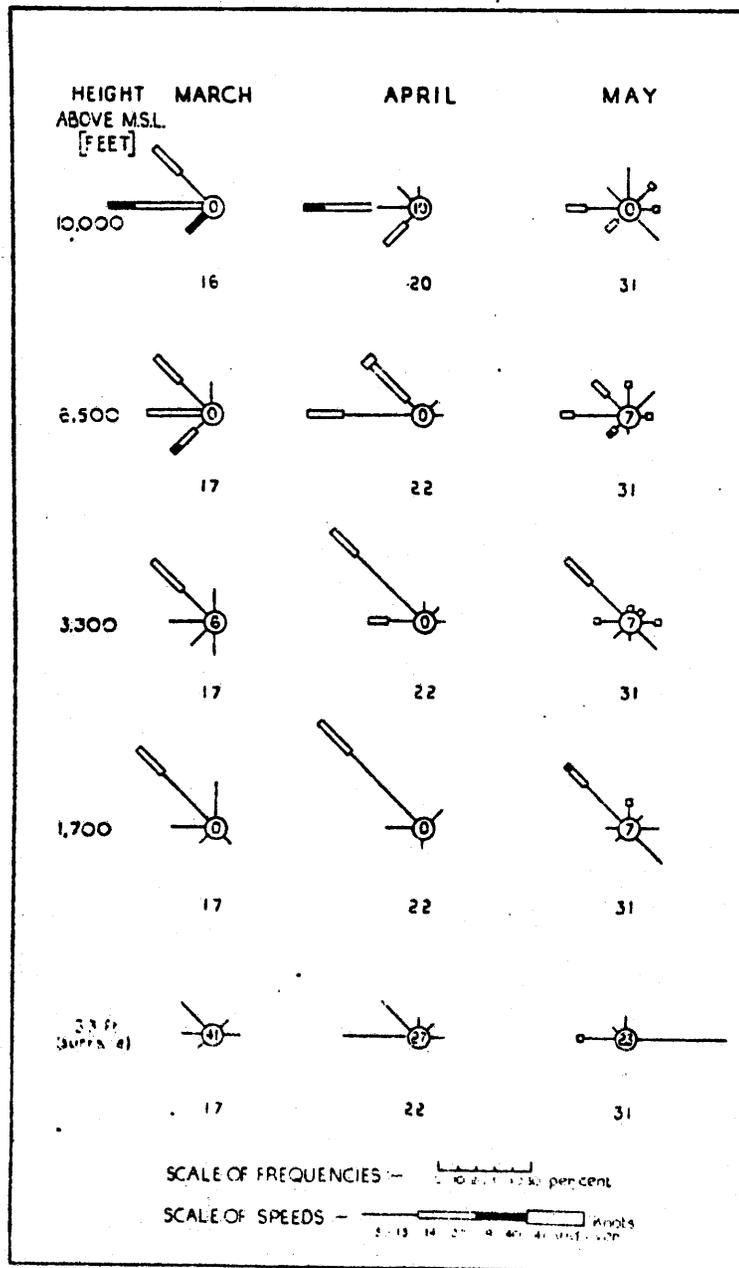


FIG. 23—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. Note the scarcity of observations at all heights.

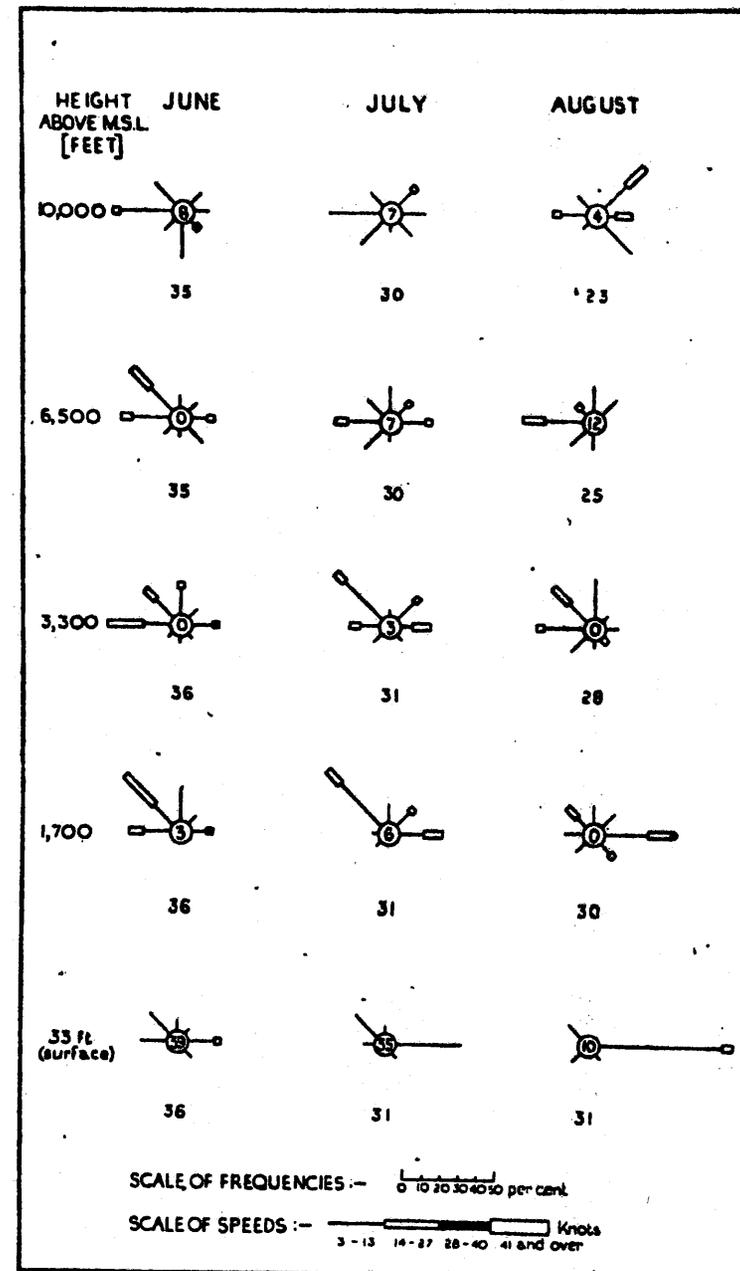


FIG. 24—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. Note the scarcity of observations at all heights.

JASK

GWADAR

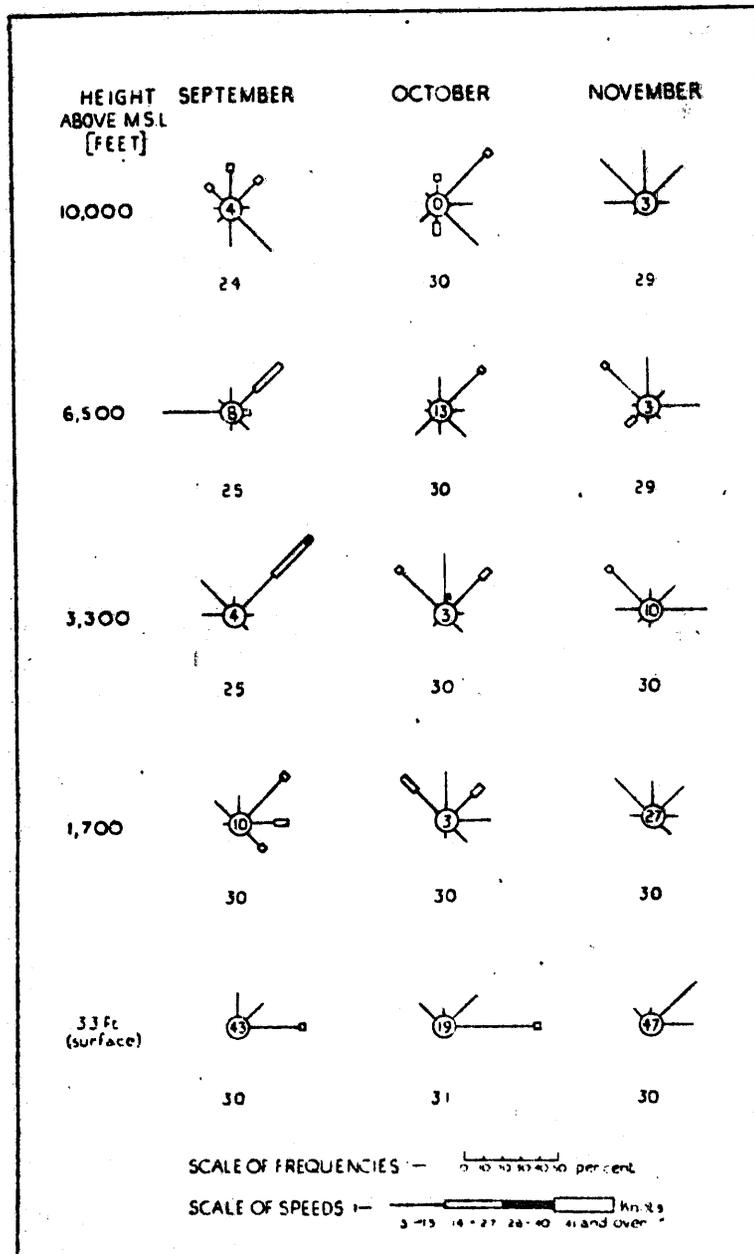


FIG. 25—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. Note the scarcity of observations at all heights.

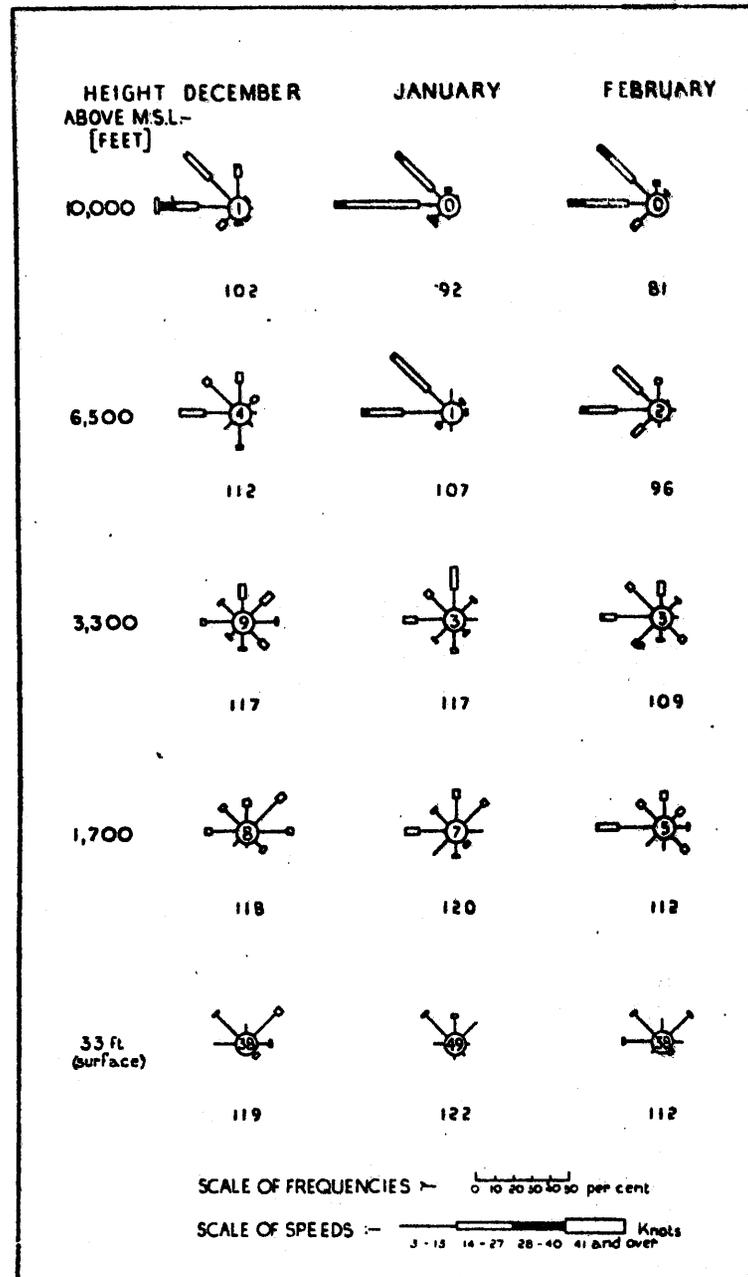


FIG. 26—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

Upper winds
GWADAR

3 61 3 62

Persian gulf and Gulf of Oman
GWADAR

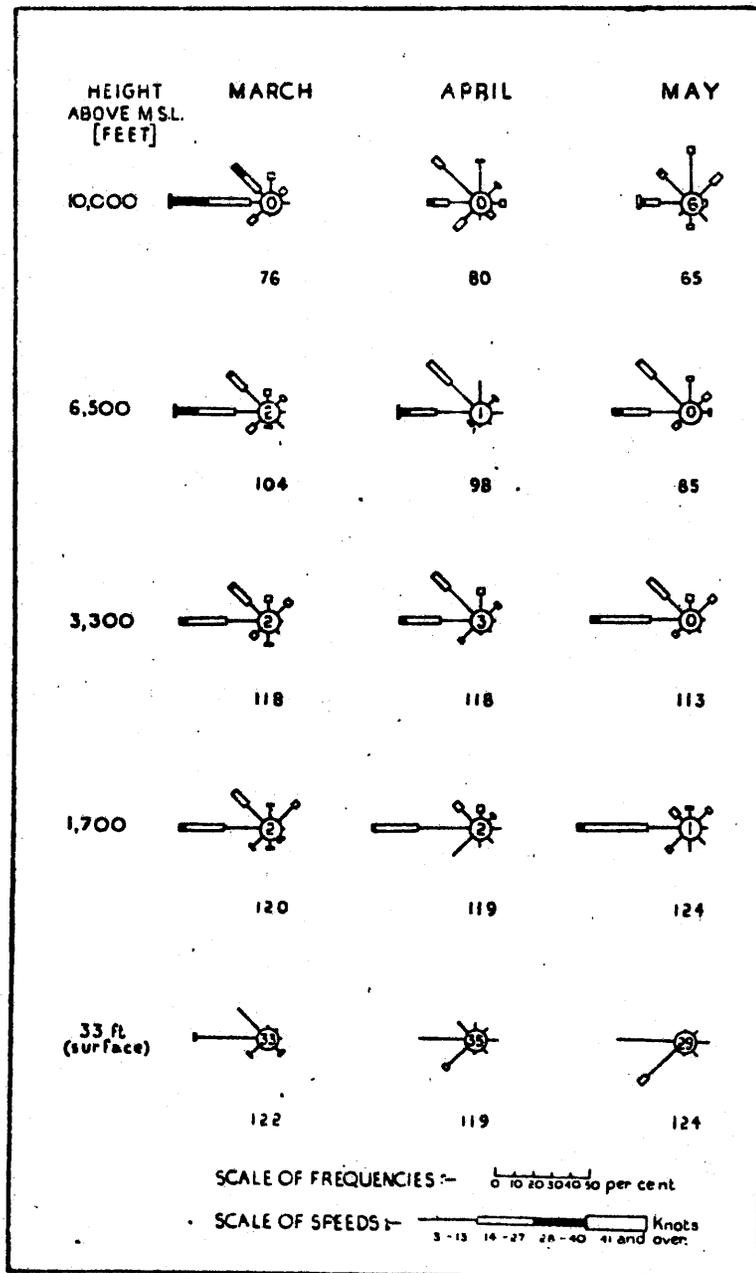


FIG. 27—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

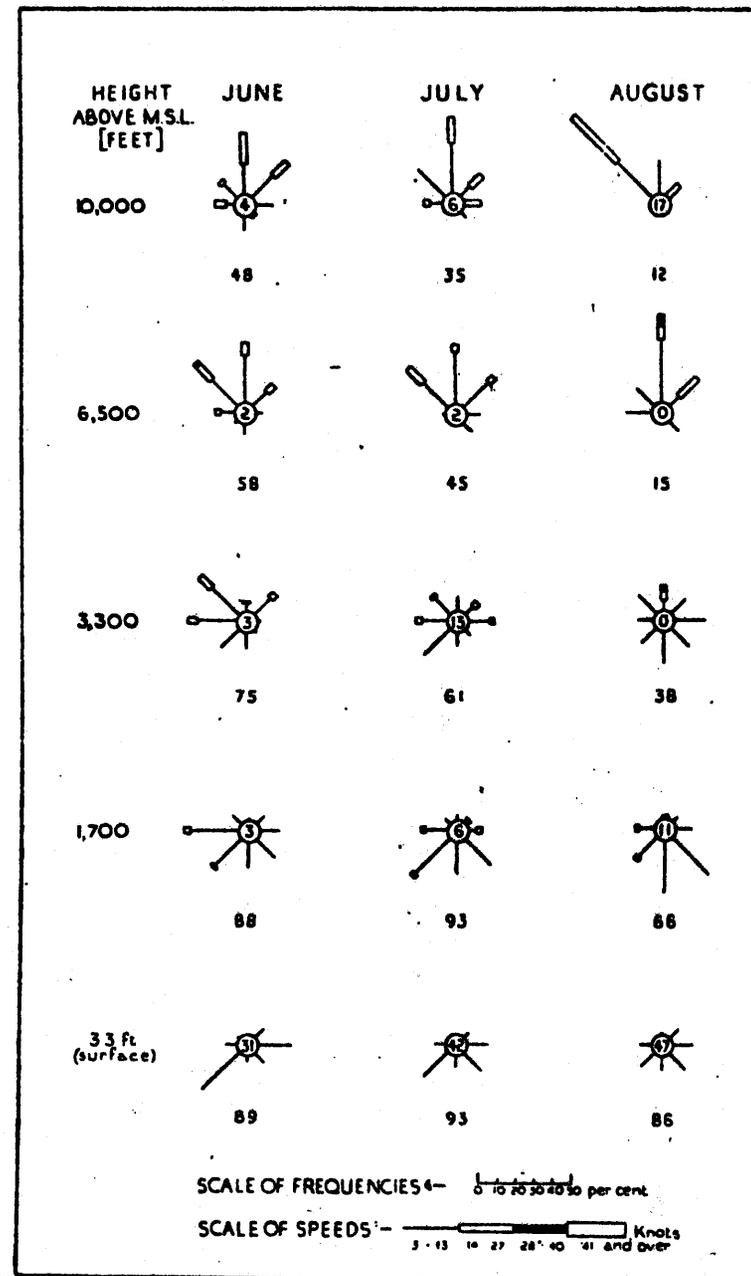


FIG. 28—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. Note the scarcity of observations at the higher levels.

GWADAR

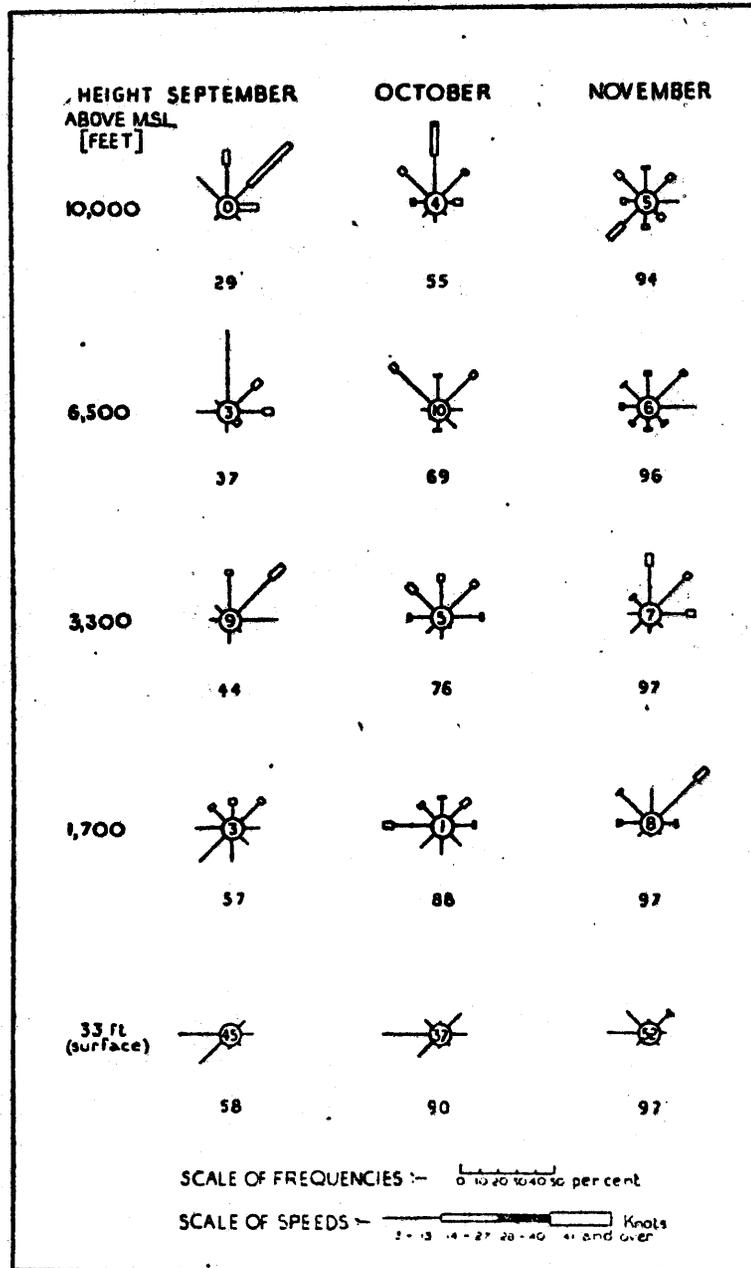


FIG. 29—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations. Note the scarcity of observations at the higher levels in September.

MUSCAT

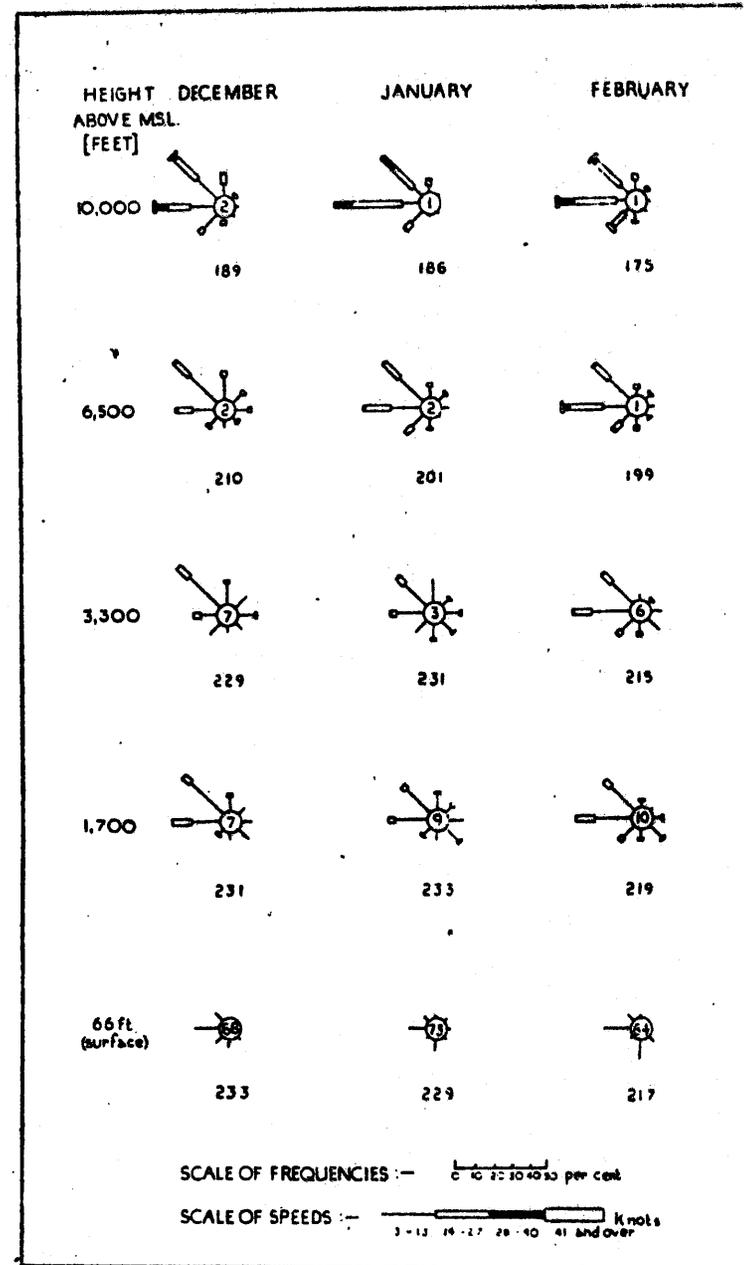


FIG. 30—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

Upper winds
MUSCAT

3 65 8 66

Persian gulf and Gulf of Oman
MUSCAT

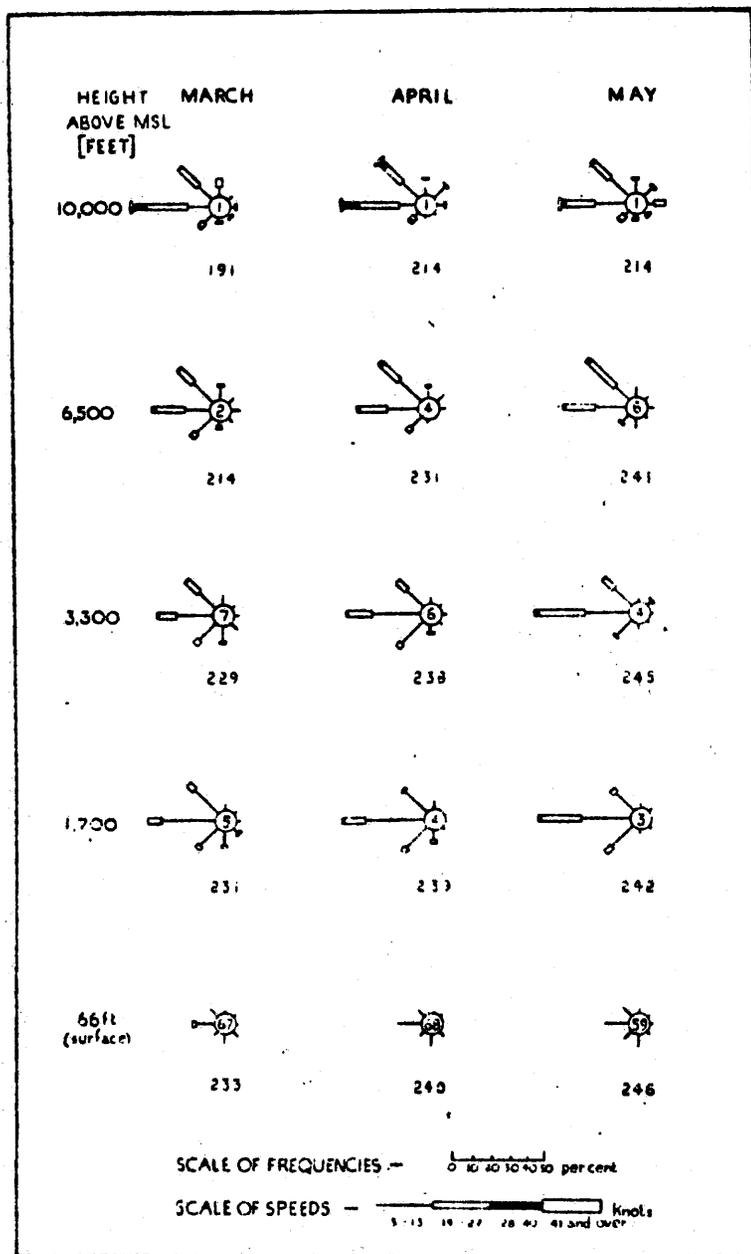


FIG. 31—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

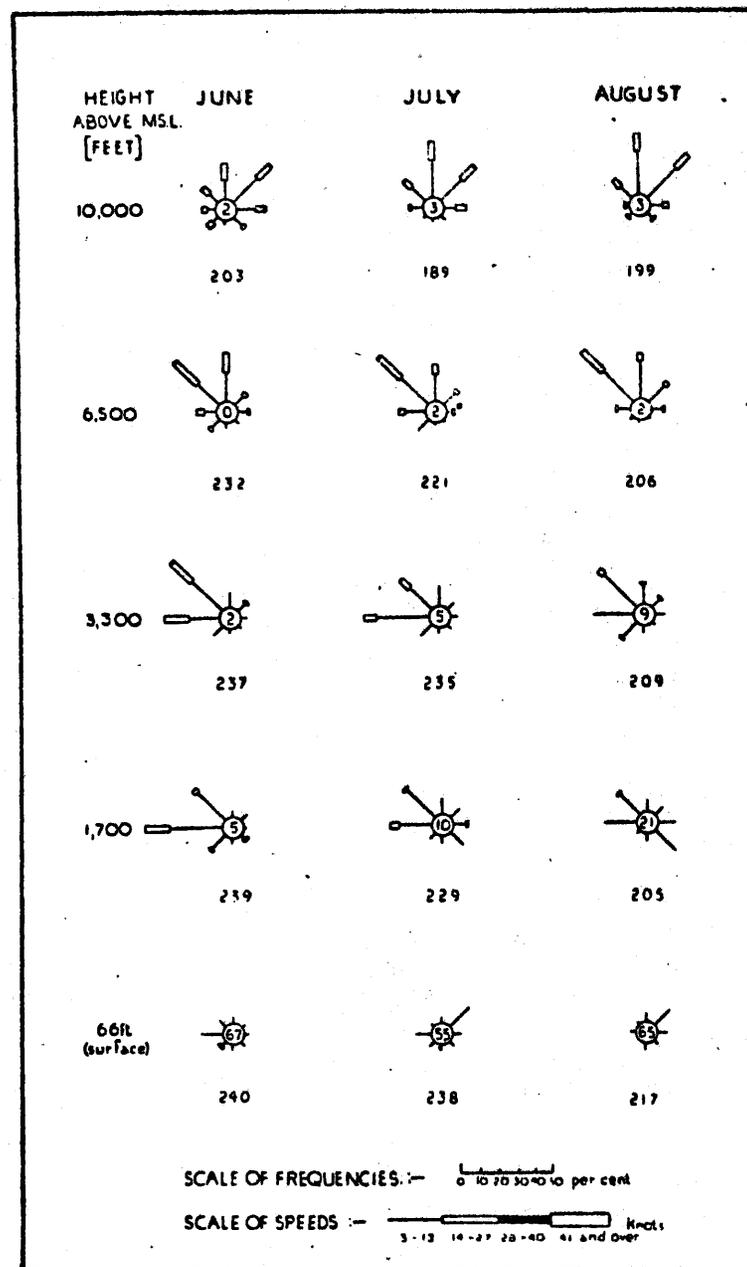


FIG. 32—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

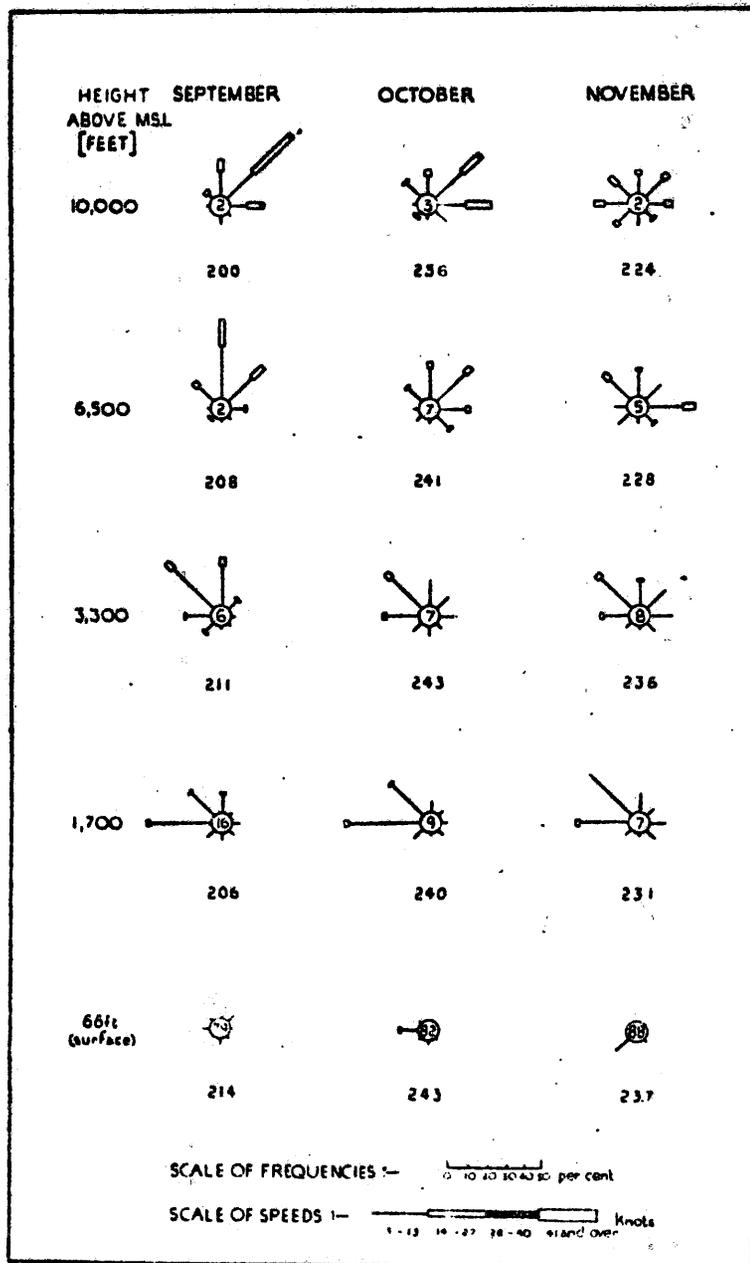


FIG. 33—UPPER WINDS—MONTHLY

Figures inside the circles indicate the percentage frequency of calms. Figures below the roses indicate the number of observations.

so at the higher levels. At 10,000 feet they are usually moderate or strong and may exceed 40 knots. At the level of high cloud, i.e. about 33,000 feet, W. winds blow almost continuously.

The westerly current, which is the most important feature of the wind circulation in the upper levels, from 6,500 feet upwards, is said to extend down to lower and lower levels as the season progresses; in December it is but little marked at 6,500 feet, but in January it is found at 6,500 feet over most of the region, and in February there are distinct signs that it not infrequently reaches down to 3,300 feet or even lower.

Severe squalls with sharp changes of wind direction may be experienced in the upper air, as at the surface, in the trough of western depressions.

Spring (March to May).—Persian gulf.—In March the winds in this region belong to the winter regime with N. or NW. winds in the lower layers backing to between SW. and NW., above 3,000 feet. These westerly winds, however, are not so strong as in February. Southerly winds are fairly frequent at 1,500 and 3,000 feet, indicating that depressions still influence the region, and occasionally at about 1,500 feet these southerly winds in March may exceed 40 knots. Easterly winds are infrequent even in the lower layers and above 3,000 feet they are almost unknown.

In April, which is a transition month, northerly and north-westerly winds are still the most frequent at 1,500 feet, and westerlies at 10,000 feet. The southerly winds associated with depressions are fewer and lighter than in March. In May the summer regime is becoming established; northerly and north-westerly winds prevail at all levels up to 6,000 feet, backing to between NW. and SW. at 10,000 feet; southerly winds are light at all heights. In the lower layers these northerly winds are stronger than in winter but they appear to decrease in strength with increasing height. In both April and May at 1,500 feet they occasionally exceed 40 knots but, as far as can be judged by the observations, they exceed this speed less frequently at the higher levels. At the level of medium and high cloud the direction is westerly or south-westerly.

Gulf of Oman and the western part of the Makran coast.—In this region the prevailing winds at 1,700 and 3,300 feet are between W. and NW.; SE. and S. winds are comparatively rare, and the depressions which influence the Persian gulf in March apparently pass too far to the north to affect the winds in the Gulf of Oman.

Westerly winds prevail also at the higher levels at the beginning of spring but they decrease in strength as the season advances and by May the winds at 10,000 feet are more variable, although W. and NW. are distinctly more common than those from other directions. Westerly winds prevail at the level of the high clouds.

On the Arabian coast of the Gulf of Oman, at Muscat, the wind at all levels up to 10,000 feet is chiefly from the west; the frequency

however of northerly and north-easterly winds increases with increasing height, especially in April and May. The movement of medium and high clouds is from between SW. and NW. The winds are rarely strong, though W. and NW. winds have occasionally exceeded a speed of 40 knots at 10,000 feet.

Summer (June to August).—Persian gulf.—The prevailing winds at all levels up to 6,000 feet in this region in summer are NW. or N. These north-westerly winds, known locally as shamal, have already been described in the section on surface winds; they are very persistent and very strong in June and the first half of July and at levels up to 3,000 feet they sometimes exceed 40 knots, decreasing slightly in strength at the higher levels. They decrease slightly both in frequency and strength in the latter part of July and become lighter and somewhat more variable in August, though even in that month they are very persistent. At 10,000 feet winds in all three months are much more variable than in the lower layers and easterly winds are not infrequent, especially in the southern part of the gulf. It is probable that in July and August the wind backs with increasing height above 10,000 feet, becoming NE. or E. at levels of about 15,000 feet and above.

Over the Arabian coast of the western section of the Persian gulf winds of gale force in the upper air are very frequent, but over the Iranian side of the eastern part of the gulf the upper winds are generally light.

Gulf of Oman and the western part of the Makran coast.—The upper winds in the lower layers in this region do not form a continuous circulation with those over the Persian gulf. There is apparently a line of discontinuity at the surface which runs in a SW. to NE. direction; at 1,500 feet the discontinuity is situated somewhere about the eastern entrance of the Gulf of Oman. This is where the N. or NW. winds of the Persian gulf meet the S. or SE. winds coming from the Arabian sea. This surface of discontinuity slopes upwards towards the SE., and the NW. winds of the Persian gulf rise above the southerly winds of the summer monsoon. The position of the surface is marked by an increase of temperature with height and sometimes by cloud. Its existence is of importance in regard to the upper winds because below it the winds are from the south and above it they are almost entirely from the north or north-west.

At Gwadar during the months from June to August winds at 1,700 feet are light and mainly from between SE. and W.; at 3,300 feet they are variable with a definite increase in the frequency of northerly winds, and from 6,500 feet upwards the winds are almost entirely from some northerly point, southerly winds being rare. The discontinuity at Gwadar therefore lies below 3,300 feet. At Jask the observations are too few to enable reliable conclusions to be drawn but they indicate that the discontinuity is even lower than

at Gwadar. South-easterly winds are almost entirely absent at 1,700 feet in June and July, and the prevailing winds at that level are from the NW., whereas in August the prevailing winds at that level are from the east. The discontinuity at Jask lies, therefore, below 1,700 feet in June and July but above that level in August.

On the Arabian coast of the Gulf of Oman, at Muscat, the winds in the lower layers in June and July are westerly veering gradually with increasing height until at 10,000 feet they become northerly and north-easterly. In the lower layers during August the winds are variable, but they become northerly at 6,500 feet, and northerly and north-easterly at 10,000 feet. In all three months the movement of medium and upper clouds indicates the existence of easterly winds at high levels.

Autumn (September to November).—Persian gulf.—In September the upper winds in this region are lighter than in summer. At 1,500 feet the prevailing wind is from NW. and N.; its direction shows little change with increasing height up to 10,000 feet but above that height it veers to NE., and the few observations of medium cloud that are available at Bahrein indicate the existence of easterly winds at about 16,000 feet.

In October winds at heights below 6,000 feet are similar to those in September with N. and NW. winds prevailing, but at higher levels the wind tends to back to W. as in the winter, and blows from this direction at the level of the medium and high clouds. By November the winter regime has become established. At heights up to 3,000 feet N. and NW. winds prevail, but southerly winds also begin to make their appearance. Above 3,000 feet the wind backs to between SW. and NW. indicating that the circumpolar westerly circulation is gradually extending to lower latitudes.

The occurrence of these southerly winds in the same month as the reappearance of the upper westerlies is probably not without significance. Westerly depressions with their associated southerly winds are not likely to occur until the upper westerlies with which they travel have become established.

Gulf of Oman and the western part of the Makran coast.—The upper winds in this region during the autumn months are light and variable. At both Jask and Gwadar NE. winds are frequent at all levels, especially in September. In October and November the winds blow chiefly from some northerly direction, becoming westerly above 10,000 feet and continuing from that direction up to the level of the high clouds.

On the Arabian coast of the Gulf of Oman light westerly winds prevail in the lower layers, which veer to NE. and E. at higher levels. In September the direction at the level of the high clouds is easterly but in October and November it is westerly.

V—VISIBILITY

Table VI gives the percentage frequencies of visibilities between various limits in each of the twelve months, at Basra (Shaibah) at three hours of the day, and at Bushire, Bahrein, Sharjah, Henjam, Jask, and Muscat at two hours of the day one in the morning and one in the afternoon. The number of days with poor visibility, i.e. visibility less than 2 nautical miles, based on the same data, is given in the general climatological tables. Most of the data are for a period of five years only, but they should suffice to give a good general idea of average conditions.

Bad visibility in the area under consideration may be due either to early morning fog, salt haze or dust. Of these, dust is by far the most frequent cause.

AVERAGE NUMBER OF DAYS WITH DUST HAZE

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Persian gulf	1	1	2	2	2	9	12	7	2	2	1	1	42
Makran coast	4	6	8	9	12	16	22	16	9	8	7	5	122

Authority.—Bibliography No. 10.

Notes.—The exact definition of dust haze is not stated.

Bad visibility due to dust haze is more frequent on the Makran coast than in the Persian gulf, and in the latter it occurs more often on the Arabian side than on the Iranian. It may occur in all seasons, but it is less frequent during and immediately after the winter rains. During the summer months when the rains cease and the temperature rises, the ground dries up and fine dust is carried up into the atmosphere. The amount of dust suspended in the air is intensified by the vigorous convection and produces a general haziness which diminishes the visibility. From May to August is the time when dust haze is most frequent. Such haze usually reduces the visibility to between 2 and 6 miles, but occasionally the visibility may become very bad, sometimes less than half a mile, and this often occurs on the day following a severe duststorm, although the wind at the time may be insufficient to raise dust.

Fog occurs at times near the shores of the Persian gulf and may be dense. It is present only in the early morning and never lasts for more than a few hours, usually clearing before noon; it is associated with anticyclonic weather during the winter months. It is probable that many reports of fog are more strictly speaking dust haze.

At times the visibility may be very good and extend to 80 or 100 miles. H.M.S. *Ormonde* reported in December 1930 that mountains distant 85 miles from the ship were visible.

Seasonal variation.

Winter (December to February).—Visibility during the winter is on the whole good over the whole region and may frequently be exceptional; ships have been known to fix their positions by the mountains on the Musandam peninsula at distances of over 50 miles. At Muscat it is said that with calm or light N. wind the visibility is usually excellent. The visibility is on the whole much better on the Iranian side of the Persian gulf than on the Arabian side where it may be frequently only fair. Visibility of 10 miles or more is recorded in about 85 per cent. of the observations at Bushire compared with 15 per cent. at Bahrein.

At the morning hour of observation (about 0800 local time) poor visibility is recorded over the whole area on less than 6 per cent. of the observations in December and on less than 16 per cent. in February, the highest figures being at Bahrein. The visibility tends to deteriorate slightly during the season; it improves somewhat between the morning and afternoon.

Morning mist and fog occur at times at most places, especially in the Persian gulf where the average frequency is about 1 to 4 days per month, but it clears soon after sunrise. Visibility may be reduced also during rain.

Duststorms occur, usually in association with the passage of cold fronts, especially on the Makran coast, and dust haze is also frequent, but less so than in the summer. During a duststorm the visibility may be reduced almost to nothing and the dust may extend to heights of 10,000 feet.

Spring (March to May).—In the early spring the visibility is mainly good or very good, especially on the north and east of the Persian gulf. In that region very good visibility, i.e. 10 miles or more, is recorded in the morning at Shaibah in nearly 80 per cent. of the observations and at Bushire in about 90 per cent.; whereas at Bahrein on the Arabian coast the frequency is much lower and is less than 5 per cent. At these places there is not much change in frequency either during the season or between morning and afternoon. In the Strait of Hormuz and in the Gulf of Oman visibilities of 10 miles or more are much less frequent especially in the latter part of the season; at Henjam, for example, their frequency at 0800 decreases from about 50 per cent. in March to only 15 per cent. in May.

In the Gulf of Oman early morning fog may occur, but it rarely, if ever, lasts long, and is usually limited to an hour before and after sunrise. About two to four mornings with thick fog have been reported in the Gulf of Oman during March, and, although most exceptional, thick fog has also been encountered around the Quoins off the Musandam peninsula in April.

Even as early as March, strong squally winds may develop into duststorms with the accompanying dust haze; as the spring advances and the dry season sets in the atmosphere as a whole

begins to get dusty and the visibility deteriorates, especially on the northern shore of the Gulf of Oman. In the Persian gulf dust haze is more frequent on the Arabian side of the gulf than the Iranian, owing to the close proximity of the Arabian desert. The dust haze may last for some days after the subsidence of the strong winds.

In May owing to the increase of dust the visibility deteriorates still further, especially over the Makran coast where it is worse than over the Persian gulf; early morning fog may also occur on about 2 days during the month. Even in May, however, poor visibility is not very frequent; it is recorded in less than 10 per cent. of the observations and in many places in less than 5.

Summer (June to August).—There is a well-marked deterioration of visibility over the whole area in June, chiefly on account of the increase of dust. On the north and east of the Persian gulf very good visibility is still comparatively frequent, being recorded in 62 per cent. of the morning observations at Shaibah and 80 per cent. at Bushire, but elsewhere it occurs much less often than in the other seasons. At Bahrein and Henjam where the visibility appears to be worse than elsewhere, it is recorded in the morning in less than 5 per cent. of the observations. During the early summer months bad visibility associated with duststorms becomes more frequent, especially during the prevalence of the strong winds of the 40-day shamal. The visibility near land is worse than at sea. This bad visibility is very frequent on the Arabian side of the Persian gulf, and in the Strait of Hormuz—in July the visibility is poor, i.e. less than 2 nautical miles, on about one occasion in three in the early morning at Bahrein and on about one occasion in four at Henjam. At Bahrein thick sandstorms, sufficient to reduce the visibility to less than a mile, are said to be caused only by fairly strong S. winds.

Bad visibility, apparently due to salt haze, occurs also over the Persian gulf during this season, and unlike the winter fogs it may last for many hours, and occasionally even until the afternoon. The visibility on the coast is usually about 4 to 6 miles, the lower visibility being towards the sea in the mornings.

In August the visibility improves considerably over the whole area, and is everywhere fair to good, but the haze still persists on the Arabian side of the Persian gulf.

Autumn (September to November).—The visibility on the whole is good in the autumn, except on occasions of early morning fog or when there is haze over the sea. It shows a well-marked improvement between August and September, and continues to improve in October and in some parts also in November. Visibilities of over 10 miles are much more frequent than in summer, and, with the exception of Bahrein, they are recorded in over 80 per cent. of the observations in November and in many places in over 90 per cent. Even at Bahrein visibility is sometimes exceptionally good in this season.

Visibility of less than 2 nautical miles occurs in less than 5 per cent. of the observations in September and October, and nearly everywhere it is even less frequent in November. Duststorms occur occasionally at the beginning of the season in association with eastern depressions and also in the latter part of the season with western depressions.

Early morning fog may occur on one or two days a month in most places, and at Gwadar on the Makran coast it is said to be more frequent in October.

VI—CLOUD

Step diagrams showing the monthly variation of mean cloud amount at the morning hour of observation are reproduced in Fig. 34. The corresponding data are given in the general climatological tables on pages 101-10.

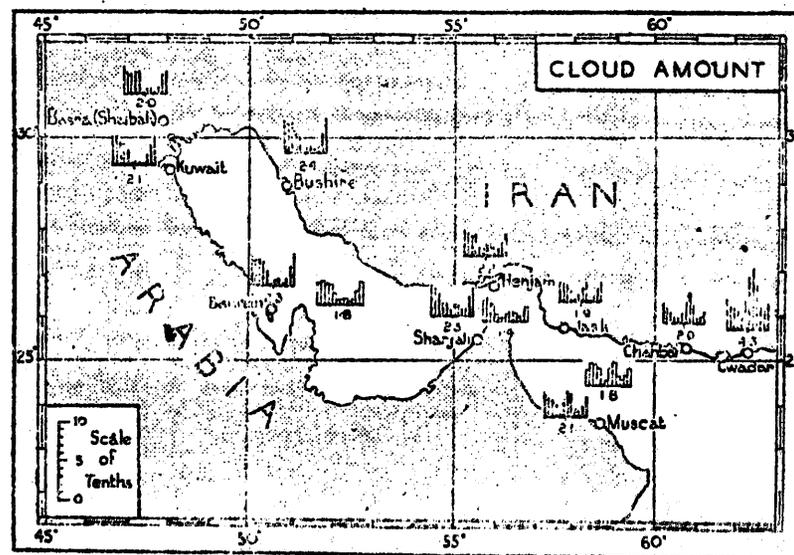


FIG. 34.—MONTHLY VARIATION IN MEAN CLOUD AMOUNT

The figures below the step diagrams indicate the annual mean cloud amount. The diagrams for land stations are for the morning hour of observation, 0530 at Basra and 0720 or 0800 at the other places.

Diagrams based on ships' observations at all hours of the day are given for three areas of the sea, between longitudes 48°-55° E., 55°-57° E. and 57°-60° E. respectively; they are distinguished by a slightly different type of diagram from that used for the land stations.

There is very little information with regard to cloud amount over the sea; the few data that are available are summarised in the following table compiled from ships' observations. The table shows the average monthly cloud amount in three areas of the sea, namely, the Persian gulf, 48°-55° E., the Strait of Hormuz 55°-57° E., and the Gulf of Oman, 57°-60° E.

Cloud

3 75

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Persian gulf	3.0	3.1	2.9	2.8	1.6	0.6	0.7	0.8	0.4	0.7	1.9	3.1	1.8
Straits of Hormuz	2.9	3.2	2.3	1.0	0.4	0.5	1.0	1.4	1.2	0.6	0.8	2.0	1.4
Gulf of Oman	2.0	3.0	2.8	2.3	0.1	0.7	2.3	3.2	1.3	0.8	1.4	2.3	1.8

Authority.—Bibliography No. 13.

Step diagrams drawn from these data are included in Fig. 34, but in order to show the difference between data for the sea and land the diagrams for the sea are in a slightly different form.

Table VII shows the monthly frequencies of different amounts of cloud at three hours of observation at Basra (Shaibah) and at two hours at Bushire, Bahrein, Sharjah, Henjam, Jask, and Muscat. For many practical purposes it is the amount of low cloud, i.e. cloud below 8,000 feet, rather than the total amount of cloud that is of importance. Monthly averages of the amount of low cloud at coastal places are accordingly given on page 76; although, except at Basra, the information is available only for the short period of four years. The corresponding averages of total cloud amount for the same period are also included, for comparison, together with the difference between the two.

The amount of cloud is comparatively small in all parts of the region. Over the Persian gulf the average for the year as a whole is only about 2 tenths or less, and it is not much greater even on the shores of the Gulf of Oman; it increases to about 4 tenths on the western part of the Makran coast.

The season with the greatest amount of cloud is not the same in all parts. In the Persian gulf the cloudiest season is the winter when the western depressions are frequent, whereas the summer is almost cloudless. In the Gulf of Oman and on the Makran coast on the other hand there are two periods of comparatively high cloud amount, one in summer and one in winter. At Jask in the west the amount in the cloudiest month both in summer and winter is about 3 tenths; but further east on the Makran coast summer is definitely the cloudiest season of the year; at Gwadar, for example, about 7 or 8 tenths of the sky is covered by cloud in July and August compared with only 4 tenths in winter. In this region the sky is frequently overcast with low cloud during the SW. monsoon.

Seasonal and diurnal variation

Winter (December to February).—In winter the amount of cloud on the shores of the Persian gulf is about 4 tenths and over the open waters of the gulf itself about 3 tenths. The eastern shore of the gulf is rather cloudier than the western. At Basra at the head of the gulf rather more than half the total amount of cloud is below 8,000 feet, but the proportion is rather less further south, and at

MONTHLY AVERAGES OF THE AMOUNT OF CLOUD OF ALL TYPES COMPARED WITH THAT OF LOW CLOUD

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
<i>tenths</i>													
BASRA (SHAIBAH)													
0500. Total	3.7	2.8	2.6	2.9	3.0	0.2	0.7	0.8	0.4	1.1	2.6	3.1	2.0
Low	2.3	1.8	1.4	1.4	1.3	0.0	0.2	0.1	0.2	0.2	1.3	1.6	1.0
Diff.	1.4	1.0	1.2	1.5	1.7	0.2	0.5	0.7	0.2	0.9	1.3	1.5	1.0
1600. Total	4.7	3.9	3.8	3.8	3.1	0.7	1.0	1.0	0.5	1.9	4.0	4.3	2.7
Low	2.3	1.9	1.7	1.7	1.0	0.5	0.9	0.7	0.3	0.4	1.4	1.8	1.2
Diff.	2.4	2.0	2.1	2.1	2.1	0.2	0.1	0.3	0.2	1.5	2.6	2.5	1.5
BUSHIRE													
0730. Total	3.5	3.1	2.9	1.5	1.3	0.1	0.1	0.5	0.5	0.5	2.9	3.8	1.7
Low	1.7	1.4	0.9	0.3	0.5	0.0	0.0	0.0	0.0	0.1	1.2	1.5	0.6
Diff.	1.8	1.7	2.0	1.2	0.8	0.1	0.1	0.5	0.5	0.4	1.7	2.3	1.1
1530. Total	3.3	3.4	2.9	1.3	1.5	0.0	0.1	0.1	0.0	0.7	2.7	3.9	1.7
Low	1.3	1.7	0.4	0.3	0.2	0.0	0.0	0.0	0.0	0.1	0.9	1.2	0.5
Diff.	2.0	1.7	2.5	1.0	1.3	0.0	0.1	0.1	0.0	0.6	1.8	2.7	1.2
BAHREIN													
0730. Total	4.2	3.5	3.2	2.1	1.9	0.5	1.4	1.5	0.5	1.3	4.0	4.9	2.4
Low	1.3	1.0	0.9	0.7	0.6	0.0	0.0	0.1	0.1	0.3	0.9	1.6	0.6
Diff.	2.9	2.5	2.3	1.4	1.3	0.5	1.4	1.4	0.4	1.0	3.1	3.3	1.8
1530. Total	4.2	3.2	3.4	2.7	2.3	0.5	1.0	0.7	0.2	1.3	4.2	4.9	2.4
Low	0.9	0.8	0.5	0.9	0.6	0.0	0.0	0.0	0.1	0.1	0.8	1.5	0.5
Diff.	3.3	2.4	2.9	1.8	1.7	0.5	1.0	0.7	0.1	1.2	3.4	3.4	1.9
SHARJAH													
0800. Total	4.3	3.9	3.2	1.8	1.7	0.9	1.7	1.6	1.0	1.1	2.7	3.9	2.3
Low	2.2	2.1	1.5	0.7	0.5	0.3	0.3	0.3	0.3	0.2	0.7	2.1	0.9
Diff.	2.1	1.8	1.7	1.1	1.2	0.6	1.4	1.3	0.7	0.9	2.0	1.8	1.4
1600. Total	4.1	3.4	2.8	2.0	1.6	0.5	1.1	1.0	0.4	1.1	3.1	3.7	2.1
Low	1.9	1.3	1.1	0.7	0.4	0.0	0.2	0.3	0.2	0.3	1.0	2.1	0.8
Diff.	2.2	2.1	1.7	1.3	1.2	0.5	0.9	0.7	0.2	0.8	2.1	1.6	1.3
JASK													
0800. Total	3.7	3.2	2.5	1.3	1.5	0.7	3.5	3.5	2.1	0.7	1.9	3.3	2.3
Low	1.5	1.4	0.8	0.9	0.7	0.1	1.6	1.6	1.5	0.3	0.4	1.3	1.0
Diff.	2.2	1.8	1.7	0.4	0.8	0.6	1.9	1.9	0.6	0.4	1.5	2.0	1.3
1600. Total	4.0	2.8	2.5	1.9	1.4	0.6	1.4	1.1	0.3	0.7	2.4	3.0	1.8
Low	1.4	1.1	0.7	1.1	0.6	0.1	0.3	0.3	0.2	0.2	0.4	1.1	0.6
Diff.	2.6	1.7	1.8	0.8	0.8	0.5	1.1	0.8	0.1	0.5	2.0	1.9	1.2
MUSCAT													
0800. Total	2.9	2.7	2.1	1.1	1.0	1.1	2.2	2.4	0.8	0.5	1.9	2.9	1.8
Low	1.4	1.3	0.5	0.7	0.4	0.6	0.8	1.1	0.5	0.4	0.6	1.5	0.8
Diff.	1.5	1.4	1.6	0.4	0.6	0.5	1.4	1.3	0.3	0.1	1.3	1.4	1.0
1600. Total	3.3	2.5	2.9	2.3	1.5	1.0	1.6	1.0	0.7	0.4	1.7	2.7	1.8
Low	1.1	0.9	1.1	0.9	0.3	0.4	0.2	0.1	0.3	0.2	0.5	1.2	0.6
Diff.	2.2	1.6	1.8	1.4	1.2	0.6	1.4	0.9	0.4	0.2	1.2	1.5	1.2
CHAMBAR													
0800. Total	3.4	2.2	2.2	1.2	1.0	2.1	4.8	4.6	2.9	0.7	1.4	1.6	2.3
Low	1.1	0.8	1.3	0.3	0.3	1.2	2.9	3.4	1.4	0.5	0.4	0.5	1.2
Diff.	2.3	1.4	0.9	0.9	0.7	0.9	1.9	1.2	1.5	0.2	1.0	1.1	1.1
1600. Total	2.9	1.9	2.0	1.3	0.7	0.7	1.9	0.9	0.4	0.2	1.3	2.0	1.3
Low	0.9	0.7	1.0	0.3	0.1	0.4	0.9	0.7	0.3	0.0	0.1	0.5	0.5
Diff.	2.0	1.2	1.0	1.0	0.6	0.3	1.0	0.2	0.1	0.2	1.2	1.5	0.8
GWADAR													
0800. Total	4.6	3.2	2.9	2.7	2.8	4.8	6.9	8.4	6.1	3.7	3.0	3.7	4.4
Low	1.7	1.3	0.9	1.3	2.3	3.7	6.1	6.7	5.3	3.0	0.6	1.2	2.8
Diff.	2.9	1.9	2.0	1.4	0.5	1.1	0.8	1.7	0.8	0.7	2.4	2.5	1.6
1600. Total	4.1	2.9	2.9	2.3	1.6	1.9	3.7	3.8	1.5	0.6	2.4	3.6	2.6
Low	1.4	1.2	0.3	0.6	0.5	1.0	2.2	2.9	1.2	0.2	0.3	1.0	1.1
Diff.	2.7	1.7	2.6	1.7	1.1	0.9	1.5	0.9	0.3	0.4	2.1	2.6	1.5

Authorities.—Bibliography Nos. 37, 39, 42.

Periods.—Basra, Mar. 1928-Feb. 1938; other stations, July 1934-June 1938.

Note.—The standard of time differs from local time by less than 20 mi.

Where possible monthly averages of the total amount of cloud at the morning hour of observation for a longer period are given in the general climatological tables.

Bahrein on the Arabian coast the average amount of low cloud is only about 1 tenth. The cloud is associated chiefly with the passage of western depressions and occasionally the sky is overcast; the chances of its being 7 tenths or more covered are 1 in 3, and of its being overcast about 1 in 10. The diurnal variation of cloud is small. At Basra the amount is about 1 tenth greater at 1600 than at 0500; but at the other places the difference between the amount recorded in the morning and afternoon is small and shows little regular variation.

Over the Strait of Hormuz, especially on its eastern side, and over the Gulf of Oman the amount of cloud is less than in the Persian gulf, the average being between 2 and 3 tenths. The amount is rather greater in January than in either December or February, but the difference is not large. Gwadar in the extreme east of the region is exceptionally cloudy with an average of nearly 4 tenths; this high figure is probably due to the fact that there is a tendency for depressions to break up near the mountains of the NW. frontier and to prolong the period of disturbed weather in that neighbourhood. In the morning between one-half and one-third of the total cloud is below 8,000 feet, in the afternoon the proportion is somewhat lower. The chances of the sky being 7 tenths or more covered are about 1 in 4, and of its being completely overcast about 1 in 10. There is very little diurnal variation.

Spring (March to May).—Over the Persian gulf the amount of cloud in spring is about 3 tenths with little, if any, difference between the amount over the sea and over the land. Except at Basra, where there is little change during the season, there is a decrease of more than 1 tenth between March and May due to the decrease in the frequency of western depressions. The amount of cloud below 8,000 feet is small; at Basra the average is between 1 and 2 tenths, but at Bushire and Bahrein it is less than 1 tenth. The chances of the sky being 7 tenths or more covered are about 1 in 4 or 1 in 5 at the northern end of the gulf, but rather less further south; completely overcast skies are rather less common than in winter. The change in cloud amount between the morning and afternoon is insignificant.

Over the Strait of Hormuz and the Gulf of Oman the amount of cloud in March is rather less than 3 tenths, decreasing from west to east. As in winter, Gwadar shows exceptionally high values. The sky becomes less cloudy as the season advances, and by May the amount is between 1 and 2 tenths on the western side of the Strait and less than 1 tenth further east. The amount of cloud below 8,000 feet is about 1 tenth in March and appreciably less than that in May. The chances of the sky being 7 tenths or more overcast are between 1 in 4 and 1 in 8 in March and about 1 in 12 in May.

Even in March completely overcast skies are less frequent than in winter and by May they are rare. The diurnal variation in the amount of cloud is small and irregular.

Summer (June to August).—In summer the distribution of cloud shows a well-marked change, and the cloudiest region instead of being at the head of the Persian gulf is in that part of the Makran coast which is affected by the moist winds of the SW. monsoon.

The Persian gulf, which is swept by the dry north-westerly shamal winds, experiences almost cloudless skies. The average cloud amount is less than 1 tenth and in some places is insignificant. Basra has almost continuous sunshine during the day from May to September. The amount of cloud decreases rapidly at the end of spring, and in June, which is the least cloudy month of the year, the average is only 0.1 or 0.2 tenths. There is a slight increase between June and August, but even in August the amount is less than 1 tenth. Cloud below 8,000 feet is almost non-existent, the small amounts shown in the table for Basra being chiefly due to dust.

The amount of cloud increases from the Strait of Hormuz eastward, and the increase is well marked east of Chahbar where the coast is more exposed to the southerly winds of the monsoon. Observations from ships indicate that the amount over the sea is rather less than on the coast. In June the amount over the Strait of Hormuz is about 1 tenth, and at Gwadar in the extreme east it is as much as 4 tenths; there is a rapid increase during the season, especially between June and July, and by August the amount is nearly double that in June.

In the Strait of Hormuz and in the western part of the Gulf of Oman the amount of cloud below 8,000 feet is less than half the total amount, but in the neighbourhood of Gwadar more than three quarters of the total cloud in the morning is due to cloud below that height. In the region to the east of Jask convectional clouds appear in the afternoon in the early part of June, but later in the month the low cloud is often stratiform in type and is related to the inversion of temperature (see page 69). The chances of the sky being 7 tenths or more covered by cloud in the morning are about 1 in 10 in the Strait of Hormuz and probably about 1 in 3 in the extreme east, though figures for Gwadar are not available. Completely overcast skies are infrequent in the Hormuz strait, but much less so further east. In the cloudy region of the Gulf of Oman there is a very well-marked clearing of the sky between the morning and afternoon hours of observation, and at Gwadar the amount of cloud in the afternoon is less than half that in the morning. This clearing is probably associated with the disappearance of the inversion of temperature.

Autumn (September to November).—Over the Persian gulf the average amount of cloud for the season as a whole is between 1 and

2 tenths. September belongs to the summer regime with almost cloudless skies, but there is a gradual increase in cloudiness during the season so that by November the amount is nearly 3 tenths and winter conditions are becoming established. In September there is very little cloud below 8,000 feet, and even in November the amount at Basra is only just over 1 tenth and it is appreciably less further south. The chances of the sky being 7 tenths or more covered are very small in September, but by November they are between 1 in 3 and 1 in 5. Completely overcast skies are rare (less than 1 per cent.) at the beginning of the season and even in November are less than 1 in 15. The diurnal variation is small and irregular except at Shaibah in November when there is a definite tendency for the amount of cloud to increase between 0500 and 1600.

In the Strait of Hormuz, and especially in the Gulf of Oman, the amount of cloud decreases rapidly between September and October, but in the west it tends to increase again slightly in November. In general September belongs to the summer regime and November to the winter, October being one of the least cloudy months of the year. In September the average amount is between 1 and 2 tenths in the west, rising to over 6 tenths at Gwadar; in October the average is about 1 tenth over most of the region, but 3 tenths at Gwadar, and in November it is between 1 and 2 tenths everywhere. As in summer, cloud below 8,000 feet accounts for the greater part of the total in September in the cloudy region near Gwadar, but elsewhere the amount of low cloud is small. The chances of the sky being 7 tenths or more cloudy are rather variable; in the west they are very small in September, but in November are about 1 in 6. In the east they are probably about 1 in 10 in November and much greater than that in September, but exact figures are not available.

During the period of the SW. monsoon there is a definite clearing of the sky in the afternoon on the Makran coast, but later in the season the diurnal variation is inappreciable.

Height.—In recent years observations of the height of cloud have become a routine observation, but sufficient data have not yet accumulated to give a reliable normal for the region under consideration, and the results quoted in the following paragraphs must be regarded as approximate only.

One method of finding the level of the cloud base is to note the height at which pilot balloons are lost in cloud. This method is subject to some limitations because occasions when no pilot-balloon ascent was practicable on account of rain, dust, or very low cloud, are liable to be omitted; such limitations are, however, likely to be less serious in a region of clear skies like the Persian gulf. The following table summarises the results obtained by this method at Bahrein and Gwadar.

HEIGHT OF BASE OF LOW CLOUD

Percentage number of days on which balloons became invisible between definite limits of height.

Height	Bahrein				Gwadar			
	Jan.	Apr.	July	Nov.	Jan.	Apr.	July	Nov.
	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.
Above 10,000	53 66	54 66	27 14	65 77	62 63	70 76	31 51	78 85
8,000-10,000	13 10	10 10	6 5	3 4	7 1	7 8	3 3	0 0
6,500-8,000	6 8	11 10	8 14	7 10	4 7	3 7	4 2	1 1
5,000-6,500	12 9	3 7	10 26	8 2	5 10	7 3	7 4	.7 0
3,300-5,000	6 1	9 0	19 20	5 0	8 5	3 2	10 8	.6 0
1,600-3,300	4 3	7 2	23 16	4 0	5 3	4 0	40 13	.7 0
1,000-1,600	0 0	0 0	1 1	0 0	0 0	.7 0	2 0	0 0
Below 1,000	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
No ascent	6 3	6 5	6 4	8 .7	9 11	5 4	3 19	19 14

Authority.—Bibliography No. 6.
 Periods.—Bahrein: a.m. Jan. 1928—July 1932; p.m. Nov. 1929—July 1932.
 Gwadar: a.m. Nov. 1927—July 1932; p.m. Nov. 1929—July 1932.

Of even greater practical importance from the point of view of aviation is information of the height of the cloud base on occasions when the sky was 9 or 10 tenths overcast. Such observations as are available are summarised in the following table:—

FREQUENCY OF SKY 9 OR 10 TENTHS OVERCAST WITH CLOUD BELOW 8,000 FEET

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
BASRA (SHAIBAH)	<i>days</i>												
0500	3	3	3	3	1	<1	<1	0	0	<1	3	4	20
0900	3	2	2	1	1	0	<1	0	0	0	1	5	16
1600	1	1	2	2	<1	1*	4*	2*	<1	1	1	2	19
BAHREIN													
morning	1	0	1	0	0	0	0	0	0	0	0	0	2
afternoon	0	0	0	0	0	0	0	0	0	0	0	0	0
SHARJAH													
morning	1	2	<1	0	0	1	<1	0	1	0	0	<1	7
afternoon	0	<1	0	<1	0	0	0	0	0	0	0	<1	1
GWADAR													
morning	2	1	1	<1	0	7	8	18	7	3	0	0	47
afternoon	<1	<1	0	0	0	0	2	7	1	0	0	<1	12

Authorities.—Bibliography Nos. 38, 42.
 Periods: Shaibah, 1935-7; Bahrein and Sharjah, 1937-8; Gwadar, Jan. 1937-Nov. 1938.

* It is probable that these occasions are due to dust and not to true cloud.

Cloud below 1,000 feet is rare. At Shaibah cloud of any amount, however small, below 1,000 feet is likely to be encountered on less than 5 per cent. of occasions even in winter when it is most frequent. In the other seasons, if dust be excluded, it is very rare.

VII—RAIN AND HAIL

1—RAIN

Step diagrams showing the monthly averages of rainfall and rain days are reproduced in Fig. 35; the corresponding data are given in the general climatological tables on pages 101-10.

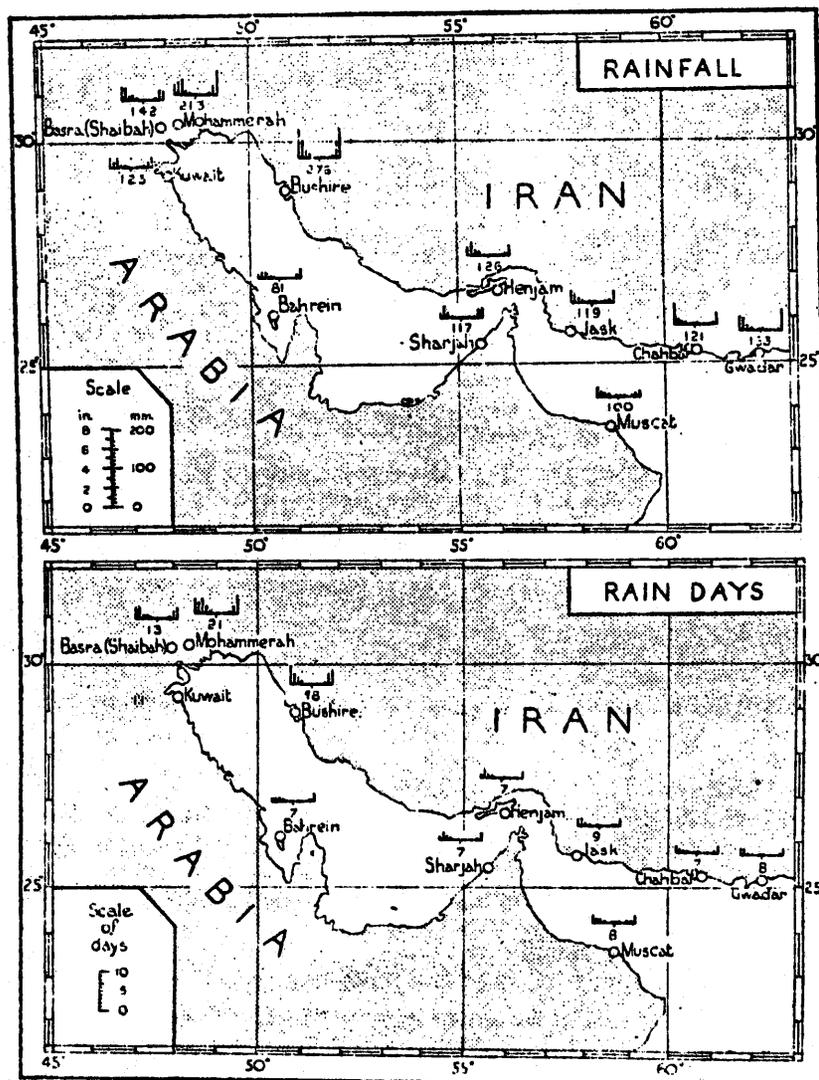


FIG. 35—MONTHLY VARIATION OF RAINFALL AND IN THE FREQUENCY OF RAIN DAYS

The figures below the step diagrams indicate the total annual amount of rain in millimetres and the total number of rain days in the year respectively. A rain day is defined as one on which 2.54 mm. (0.1 in.) or more of rain falls.

The definition of a rain day adopted in this Part is that used by the Indian Meteorological Department, namely a day on which 2.54 mm. (0.1 in.) or more of rain falls.

General.—Over the greater part of the region the climate is of the "desert" type. The small and variable amount of rain that falls depends a good deal on the configuration of the land, and the places with the heaviest falls are amongst the hills.

The rainfall is limited almost entirely to the winter months, November to April, and is usually associated with the passage of western depressions. In the Persian gulf it is heaviest on the coast of Iran, where it is accentuated by the orographic effect of the high land near the coast. From May to October rain falls only in occasional years.

On the western part of the Makran coast the rainfall is uncertain and small, sometimes there is hardly any rain for two or three years but occasionally a large fall may occur.

Annual rainfall.—In the Persian gulf the rainfall is least on the southern part of the Arabian coast, where the total fall for the whole year is less than 100 mm. (4 in.). It increases slightly towards the north-west and exceeds 200 mm. (8 in.) at Mohammerah, and 275 mm. (11 in.) at Bushire. Over the Strait of Hormuz and the Gulf of Oman the average is between 100 and 125 mm. (4 and 5 in.) rising to 163 mm. (6.4 in.) at Gwadar.

The number of rain days is very small. Over nearly the whole area it is less than 10, but it exceeds that figure at the head of the Persian gulf, rising to 18 at Bushire and to 21 at Mohammerah.

Seasonal variation.—On the average the amount of rain is greatest in December and January, but even in the wettest of those months the average at most places is only about 35 mm. (1.4 in.) and there are only 2 or 3 days in the month when the amount of rain exceeds 2.5 mm. At the north-western end of the gulf the amount is rather greater, the average in December, which is the wettest month, is 63 mm. (2.5 in.) at Mohammerah and 80 mm. (3.1 in.) at Bushire falling on 4 or 5 days. The rain in this season is almost invariably associated with the passage of western depressions, and is heavier on the Iranian coast than on the Arabian. Owing to the orographic effect heavy rain may occur before the arrival of the warm front on the Iranian coast though there is only drizzle on the Arabian coast.

At Muscat on the Arabian coast of the Gulf of Oman rainfall, due to the cold fronts of western depressions, often arrives after it would normally be expected from the position of the front, the delay in some cases being as much as a day. This is probably due to an orographic effect as Muscat is situated on the lee side of the hills.

Records at Basra indicate that rainfall is most frequent between 0400 and 0800 and least frequent between 2000 and midnight.

In spring the rainfall is usually associated with thunderstorms. In March it is appreciable in some years probably in association with western depressions, but the average nowhere exceeds 40 mm. (1.6 in.) and in most places is less than 20 mm. (0.8 in.). Very little rain falls in April, and more often than not May is entirely rainless.

In summer the whole region is nearly always completely rainless, but east of Jask heavy rainstorms have been known to occur.

The dry season usually continues until the end of October, and in November rain begins to fall again, though the average is nearly everywhere less than 25 mm. (1 in.). In the Persian gulf heavy thundershowers occur in some years in October and November in association with western depressions.

Extremes of annual and monthly rainfall.—The following table gives the highest and lowest amounts of rain that have been recorded in each month and in the year at Shaibah, Bushire, Bahrein, Jask, Muscat and Gwadar.

MAXIMUM AND MINIMUM MONTHLY AND ANNUAL RAINFALL

The period over which the observations extend is given in brackets under each place

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year	
	<i>millimetres</i>													
(a) Shaibah (15 years)	84 5	73 1	41 tr(1)	29 0(3)	11 0(7)	0	0	0	2 0(14)	0	21 0(10)	194 <1	89 <1	307 50
(b) Bushire (31-5 years)	328 0(1)	169 0(3)	119 0(3)	54 0(18)	14 0(4)	0	0	0	5 0(34)	0	52 0(16)	297 0(17)	337 0(5)	670 0(1)
(c) Bahrein (21-2 years)	31 0(8)	69 0(3)	65 0(4)	28 0(6)	13 0(14)	0	0	0	0	0	4 0(20)	70 0(13)	91 0(4)	227 14
(b) Jask (37-8 years)	151 0(5)	80 0(10)	121 0(15)	59 0(21)	9 0(36)	21 0(33)	16 0(36)	7 0(37)	0	0	47 0(39)	73 0(20)	120 0(7)	228 8
(b) Muscat (37-8 years)	143 0(6)	99 0(7)	65 0(14)	98 0(24)	4 0(37)	64 0(34)	8 0(35)	15 0(34)	0	0	44 0(31)	77 0(19)	116 0(10)	265 12
(c) Gwadar (8-10 years)	119 0(3)	149 0(2)	69 0(2)	84 0(3)	0	9 0(3)	64 0(7)	0	0	0	0	17 0(5)	258 0(2)	323 102

Authorities.—Bibliography Nos. (a) 42, (b) 8, (c) 37.

Note.—The figures in brackets indicate the number of times during the period that the particular month had no measurable rain; no figure is given for the months when rain has never been known to fall.

The normal rainfall is given in the general climatological tables.

The table shows that any month of the year may occasionally be rainless in any part of the region. Rain is extremely rare in any of the months from June to September and in the Persian gulf is almost unknown; in the Gulf of Oman it has been known to fall on very rare occasions in June, July and August in association with eastern depressions but in no part of the area has it ever been recorded in September.

In the winter months rain is sometimes comparatively heavy. Floods occasionally occur at Baghdad on the Tigris river. A very heavy rainfall in January 1896 caused the river to rise 8 feet in

one night, with the result that the embankments were broken down and a sea of water about 25 miles in length and some 6 miles wide, formed round Baghdad. The water rose to a higher level than the city which is, however, surrounded by a glacis. In April 1894 and March 1923 floods also occurred. On the latter occasion the river again burst its banks flooding 300 square miles of desert and isolating the city.

On the Arabian coast of the Persian gulf falls exceeding 100 mm. (4 in.) in a month are practically unknown, but on the Iranian coast at Bushire, 300 mm. (12 in.) has been exceeded in both December and January. In the Gulf of Oman falls of over 100 mm. (4 in.) have been recorded from December to March, and 250 mm. (10 in.) was recorded at Gwadar on one occasion in December and 150 mm. (6 in.) in February.

Maximum rainfall in 24 hours.—Monthly values of the highest records of rainfall in 24 hours, from one morning observation to the next, are given in the general climatological tables on pages 101-10.

The heaviest fall shown is 140 mm. (5.5 in.) at Bushire in January. Such a heavy fall is quite exceptional and in most parts the heaviest fall has not exceeded 80 mm. (3.1 in.).

During the passage of a tropical cyclone on June 4-5, 1890 it rained for 24 hours continuously at Muscat and nearly 300 mm. (12 in.) of rain fell.

2—HAIL

Hail is very rare in any part of the region. It is experienced very occasionally during the months from November to April in association with thunderstorms.

VIII—TEMPERATURE

1—AIR TEMPERATURE

Data of the monthly means and extremes of the temperature of the air at coastal places are given in the general climatological tables on pages 101-10. The table below, compiled from ships' observations, gives the mean temperature of the air over the sea in the Persian gulf, the Strait of Hormuz, and Gulf of Oman.

MEAN TEMPERATURE OF THE AIR OVER THE SEA

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	<i>degrees Fahrenheit</i>											
Persian gulf												
48-50° E.	59	60	64	71	80	85	90	91	89	83	72	64
50-52° E.	65	65	68	75	80	84	89	91	89	85	78	69
52-55° E.	68	69	72	78	81	85	90	91	90	87	80	72
Strait of Hormuz												
55-57° E.	69	70	73	77	82	87	90	92	90	85	80	73
Gulf of Oman												
57-59° E.	70	71	74	80	85	88	88	86	85	84	79	74
59-60° E.	71	72	74	80	85	85	84	82	81	82	79	75
60-62° E.	72	73	75	80	84	84	83	81	81	82	78	75

Authorities.—Bibliography Nos. 13, 42.

Note.—Very few data are available in some parts so that the temperatures are only approximate.

General.—The average annual temperature in different parts of the region varies between 75° and 82° F. At the head of the gulf and on the northern part of the Iranian coast the average is 75° F.; it is about 78° F. on the Arabian coast, rises to 80° F. in the Strait of Hormuz, and falls to 78° F. on the Makran coast. Muscat is exceptional with the high average temperature of 82° F., which is said to be due partly to a föhn effect.

In the Persian gulf and Strait of Hormuz the hottest months of the year are July and August, but in the Gulf of Oman the period of greatest heat is in June before the arrival of the SW. monsoon. Over the whole region January is the coolest month.

The annual range of temperature is much greater at the head of the Persian gulf than further south. Over the sea in that region the difference between the mean temperature of the hottest and coldest months exceeds 30° F., and at Basra (Shaibah) it is as much as 44° F. The annual range diminishes southward along the gulf; in the Strait of Hormuz it is about 22° F. over the sea and 25° F. on the coasts, and in the eastern part of the Gulf of Oman it is 14° F. over the sea and about 22° F. on the coasts.

The daily range of temperature over the sea is not likely to be large, except in the immediate neighbourhood of the land. On the coasts it depends very much on the degree of exposure to the sea. On the average, taken over the year as a whole, it is about 10° F. at Muscat; rather less than 15° F. on the Makran coast, and over the greater part of the coast of the Persian gulf, more than 20° F. at the head of the gulf and nearly 30° F. at Shaibah. It is subject to annual variation, being least in the rainy season.

The extremes of temperature on record range from 19° F. in December to 125° F. in July, a difference of 106° F.; both were recorded at Basra (Shaibah). The extreme range over which the temperature is likely to vary in any single year is from 27° F. to 119° F. at Shaibah and from about 45° F. to 105° F. elsewhere.

Seasonal variation

Winter (December to February).—The average temperature of the air over the middle of the Persian gulf in winter is some 5° F. higher than on the coasts in the same latitudes, and there is at the same time a well-marked gradient of temperature from south to north. January and February are the coolest months of the year and the lowest temperatures often occur in the first half of February.

Over the sea, in those months, the temperature at the head of the gulf is about 60° F.; it rises steadily south-eastwards to 70° F. in the Strait of Hormuz, and to 72° F. off the Makran coast. On the coast the temperature at the head of the gulf ranges from about 50° F. at night to 60° F. in the hottest part of the day, though inland at Basra (Shaibah) the night temperature falls below 45° F. The temperature

at Shaibah in January is very similar to that experienced in south-east England in May. In the Strait of Hormuz the temperatures are higher than at the head of the Gulf by some 10° F., ranging from 60° F. at night to between 70° and 75° F. by day, so that in this area even in mid-winter temperatures are several degrees higher than are normally experienced at mid-summer in south-east England. On the Makran coast the range of temperature is from 57° F. at night to 73° F. during the day, and at Muscat on the southern shore of the Gulf of Oman from 66° F. at night to 75° F. by day.

On some occasions high temperatures have been reached even in mid winter. In all parts and in all months the temperature has exceeded 80° F.; the highest temperatures on record in this season have been recorded at Muscat with 87° F. in January and 96° F. in February.

Frost is almost unknown except near the head of the Persian gulf. At Basra (Shaibah) a temperature of 19° F. has been recorded, and at Kuwait one of 27° F.; at Bushire also the thermometer has fallen to 32° F., but in other parts of the gulf the temperature rarely falls much below 40° F., and at Muscat, during a period of 38 years, the lowest temperature recorded is 49° F. Over the sea the temperature is not likely to fall much below 40° F. even at the head of the gulf, and in the Strait of Hormuz and Gulf of Oman it rarely falls below 60° F., except possibly in the immediate neighbourhood of the coast.

Spring (March to May).—The temperature rises rapidly throughout the season. Over the sea at the head of the gulf the temperature in May is 20° F. higher than in February, over the southern part of the gulf it is between 12° and 15° F. higher than in February, and in the Gulf of Oman 13° F. higher. On the land the rise is even more rapid. At Basra (Shaibah) the average rise from February to May is 30° F., which is more than the average difference between mid summer and mid winter in south-east England; further south the rise is less and amounts to 24° F. at Bushire, 22° F. at Bahrein and to 17° or 18° F. on the Makran coast.

The distribution of temperature in May is very different from that in winter. The gradient of temperature from south to north is much less steep, and owing to the very rapid rise of temperature over the land the temperature on the coasts is some 3° or 4° F. higher than over the sea in the same latitudes.

Over the sea the temperature is about 80° F. over the whole of the Persian gulf, with very little variation from place to place; it rises to 82° F. in the Strait of Hormuz and to 85° F. over the Gulf of Oman.

On the coasts in May the temperature is already very high. The average is about 85° F. At night the temperature falls to between 75° and 80° F. in most places, and by day it rises to 90° or 95° F. on

the coast, and to over 100° F. inland. Except at the head of the Persian gulf the temperature rarely falls below 65° F. in May, and even at Basra (Shaibah) the lowest temperature ever recorded in May is as high as 59° F. In all parts the temperature has been known to exceed 103° F., at Basra on one occasion it rose to 115° F. and at Muscat and Gwadar to 112° F.

Summer (June to August).—Over the Persian gulf the temperature reaches its highest values in July and August. The distribution in those months is similar to that in May, but the values are about 10° F. higher. Over the sea the average everywhere is about 90° F., on the coasts it is about 1° or 2° F. higher, ranging from between 80° and 85° F. at night to between 95° and 105° F. during the day. Inland the temperature is considerably higher and at Basra (Shaibah) the average at the hottest time of the day in August is 112° F.

Over the Strait of Hormuz the average temperature in August is about 92° F., and differs little from that on the coasts where the daily range is from 85° F. to 97° F.

Over the Gulf of Oman June is the hottest month with an average temperature of 88° F. at the western end of the gulf and 84° F. off the Makran coast. With the onset of the SW. monsoon the temperature falls appreciably, especially in the east, and by August there is a well-marked gradient eastwards along the gulf. In that month the temperature is about 87° F. off the eastern coast of the Musandam peninsula, it falls to 82° F. off the Makran coast, and to below 80° F. off Ras al Hadd. Owing to the cloudy skies the daily range is small, at Gwadar the temperature rises to 87° F. by day and falls to 77° F. at night, and at Muscat to 91° F. by day and 84° F. at night.

The temperatures in August are sometimes exceptionally high, and with the lighter winds which are characteristic of the latter part of the summer the heat is often very oppressive. Over the sea the temperature is not likely to rise above 100° F. The heat increases inland, and at Basra (Shaibah) in June, July, and August the temperature has been known to exceed 120° F.; even on the coast it has risen above 110° F., and it rarely falls below 70° F. At Khor Kuwait (26° 21' N., 56° 22' E.) off the western end of the Musandam peninsula, the heat in summer has been reported to be intense. H.M.S. *Sphinx*, whilst there early in August 1906, remarked that with a free circulation of air under double awnings, for three days and nights the lowest temperature at night was 90° F. and the highest during the day was 99° F.

Autumn (September to November).—In September the distribution of temperature differs little from that in the summer months. Over the Persian gulf the average temperature is nearly 90° F., and along the Gulf of Oman there is a steep gradient eastwards, the temperature falling from 90° F. in the Strait of Hormuz to little more than 80° F. off the Makran coast.

Between September and October the temperature over the Persian gulf falls appreciably, but in the Gulf of Oman it changes very little, and on the Makran coast it rises slightly as soon as the SW. monsoon begins to recede. On that coast it is not until the end of October or early in November that any fall of temperature is apparent.

In November the gradient of temperature from south to north, which is characteristic of the winter months, has become re-established, and the temperature of the air over the sea is again higher than that over the land. At the head of the gulf the temperature over the sea is about 72° F.; it rises southwards along the gulf at first rapidly and then more slowly, reaching 80° F. in the Strait of Hormuz. On the coast the temperature in the extreme north ranges from about 60° F. at night to 80° F. by day. Further south and on the northern shore of the Gulf of Oman the temperature at night is between 65° and 70° F. and in the day between 80° and 85° F. At Muscat it ranges from about 75° F. at night to 85° F. by day.

At Basra (Shaibah) the weather may be cold even in November, and a temperature as low as 32° F. has been recorded, with 42° F. at Bushire; elsewhere the temperature rarely falls below 50° F. High temperatures are not infrequent, and values exceeding 90° F. have been recorded in all parts of the region. Temperatures above 100° F. have been experienced in September and October, but they are not likely to occur in November.

Diurnal variation.—Over the open sea the diurnal range of temperature is probably not more than 2° or 3° F., though it is likely to exceed that value in the immediate neighbourhood of the coast. On land the local exposure of the place of observation has a considerable effect on the range and there will be differences also from one season to another. In general the range is greater in the dry season than in the wet. At the head of the Persian gulf, where winter is definitely the cloudy and rainy season, the range shows a large annual variation; at Basra (Shaibah) the range in the winter months is about 20° F., it exceeds 25° F. during the other months of the year and reaches a maximum of 35° F. in September, which is more than twice the average at Kew Observatory in the same month.

Elsewhere in the Persian gulf the range is less and is for the most part between 10° and 15° F., showing little regular variation from month to month.

On the northern shore of the Gulf of Oman the average for the year as a whole is 14° F. The range is greatest in late autumn when it amounts to 18° F., and falls to only half that amount in July and August during the cloudy weather of the SW. monsoon. At Muscat on the southern shore the range is small throughout the year; the average is only 9° F., and in no month does it differ from that by more than 2° F.

2—SEA TEMPERATURE

The isotherms of sea surface temperature of 70°, 80°, and 90° F. are shown in the monthly charts of surface winds, Figs. 4-9 on pages 18-23.

In the Persian gulf and Strait of Hormuz the temperature of the sea surface reaches its lowest value in February, and its highest in August; at the northern end of the gulf the annual range in the monthly means is nearly 30° F., from about 60° F. in February to 90° F. in August; in the south the range is about 20° F., the winter temperatures being some 10° or 12° F. higher than in the north and the summer temperatures almost identical. Throughout the year except possibly in May the temperature off the Arabian coast is usually a degree or two lower than off the Iranian coast.

In the Gulf of Oman also, the lowest temperature on the average is in February, but the highest values of the year occur in July at the western end of the gulf and as early as June at the eastern end. The arrival of the SW. monsoon prevents the continued rise of sea temperature through the summer. In this region the annual range is between 10° and 15° F.; less than half that at the head of the Persian gulf.

Seasonal variation

In the winter months from December to February there is a well-marked gradient in the temperature of the sea surface along the Persian gulf. The lowest temperatures are in the extreme north, where in December the average is about 65° F., and in February about 60° F. The temperature increases southwards, at first rapidly and then more slowly, and in the south of the gulf and in the Strait of Hormuz the average in December is about 74° F., and in February, about 71° F. In the Gulf of Oman and off the Makran coast the corresponding values are 75° F. in December and 72° or 73° F. in February.

During the spring the temperature gradually increases, the most rapid rise being between April and May. In the north the rise of temperature is greater than in the south, so that the steep gradient of temperature which is characteristic of the winter months gradually slackens, and by May the difference between north and south is only 5° F., from 77° F. at the head of the gulf to 82° F. in the Strait of Hormuz. There is a further slight increase eastwards along the Gulf of Oman to about 84° F. off the Makran coast.

During the cloudless summer months the temperature of the water of the Persian gulf continues to rise, and by August the temperature in all parts is rather more than 90° F., with very little difference from place to place. In summer the conditions on board ship may be very trying owing to this excessively high sea temperature which in August and September has been known to reach 98° F., and, except at the head of the gulf, is seldom below 90° F.

In the Gulf of Oman and off the western part of the Makran coast conditions are somewhat different and temperatures are lower. Owing to the arrival of the SW. monsoon the temperature in the eastern part of the gulf ceases to rise in June, and in the western part in July, and there is a gradual fall of 1° or 2° F. until September. In the hottest month the temperature in the western end of the gulf is 88° or 89° F. and off the Makran coast 84° F.; throughout the summer there is a slight gradient of temperature from west to east. In August the sea temperature at the western end of the gulf is about 87° F. and off the Makran coast 82° F., but it falls to less than 80° F. off Ras al Hadd. The much lower temperatures in this region compared with the Persian gulf are probably due partly to the effect of the SW. monsoon and the cloudy skies associated with it, and partly to the much greater depth of water.

In September the sea temperature of the Persian gulf and of the Strait of Hormuz begins to fall; the fall is more rapid at the northern end of the gulf than at the southern so that a well-marked gradient gradually becomes established, and in November the temperature at the northern end is about 73° F. and at the southern end about 82° F.

In the Gulf of Oman there is not much change of temperature between August and October. At the western end there is a fall of about 2° or 3° F., but at the eastern end the temperature tends to rise slightly in October as the SW. monsoon recedes. Over the whole of the gulf there is a well-marked fall between October and November, and in the latter month the sea temperature is about 80° F.

3—RELATIVE VALUES OF SEA AND AIR TEMPERATURE

The difference between the temperature of the surface of the sea and of the air above it is comparatively small at all times of the year. The air is generally colder than the sea from about October to February and warmer than the sea from about March to July. In August and September the air is warmer than the sea in the Persian gulf and colder than the sea in the Gulf of Oman.

The differences in temperature, however, are nowhere very large, and, on the average, in no month are they likely to exceed 5° F. in the coastal regions and 3° F. over the open sea.

IX—HUMIDITY

The general climatological tables on pages 101-110, give the mean monthly relative humidity in the morning and afternoon at Basra (Shaibah), Bushire, Bahrein, Sharjah, Jask, Chahbar, and Gwadar, and in the morning only at Henjam and Muscat. The mean monthly wet-bulb temperatures are also included in the tables. It should be noted that at most places the mean values are based on a period of four years only, and owing to the large variation in the monthly values from one year to another a mean based on so short a period is liable to considerable uncertainty.

General.—At Basra (Shaibah) at the head of the Persian gulf and on the northern part of the Arabian coast the relative humidity shows a well-marked seasonal variation with highest values in the winter, which is the rainy season, and lowest values in the late spring or in the summer. At Bushire on the Iranian coast, and at Sharjah, the maximum is also in winter, but there is a secondary maximum in summer, and the lowest values are in the transition months of April–May and September. In the Gulf of Oman there are also two maxima in the year; at the western end of the gulf the two are of almost equal importance, but further east the principal maximum is in summer and the secondary in winter. The seasonal variation is thus similar to that of cloud amount.

The diurnal variation of relative humidity is large, and in discussing and comparing the data it is important to know the hour at which the observations are made. The following seasonal notes are based on observations at approximately 0730 or 0800 local time unless otherwise stated. Where the values are for the afternoon they are for the hours 1530 or 1600.

Seasonal variation

Winter (December to February).—Over the open sea the mean relative humidity in January is between 70 and 80 per cent.; observations are too few to show the details of the distribution.

On the coasts on the north of the Persian gulf where winter is the rainy season the relative humidity at the morning hour of observation exceeds 80 per cent., and at the time of maximum probably exceeds 90 per cent. At Basra (Shaibah) and Bushire January is usually the most humid month, at Bahrein the change from month to month is small and irregular. The humidity decreases southwards to about 75 per cent. or less in the Strait of Hormuz. On the northern shore of the Gulf of Oman the relative humidity increases eastwards from about 70 per cent. at Jask to about 80 per cent. at Gwadar. At Muscat, on the southern shore, the mean is just under 70 per cent.

The humidity in the afternoon is likely to be between 10 and 20 per cent. lower than in the morning, and inland it may be 30 per cent. lower.

No information is available as to the range of values likely to be recorded over the sea and on the coasts, but at Basra (Shaibah) the air may on some occasions be completely saturated, while on others the humidity may be as low as 12 per cent.

Spring (March to May).—During the early spring the humidity gradually decreases over the whole region. Over the Persian gulf this decrease continues throughout the season, and in May the average on the coasts at 0730 is about 70 per cent. Inland at Basra (Shaibah) the fall during the spring is very rapid, and in May

the average at the time of greatest humidity is only 55 per cent. and at 0900 only 30 per cent. Sharjah in the south also shows the low value of 55 per cent.

On the northern shore of the Gulf of Oman the humidity increases slightly between April and May in the east, but in the west and on the southern shore it continues to decrease throughout the spring months, so that by May there is a well marked increase of humidity eastwards from about 65 per cent. at Jask to over 80 per cent. at Gwadar.

At Shaibah, the humidity has been known to fall below 5 per cent. in all the spring months, indicating almost completely dry air, though by contrast, on some occasions the air may be saturated. The normal daily range in this season at Shaibah is between 35 and 45 per cent. On the coasts the difference of humidity between the morning and afternoon decreases during the spring, and by May it is small at most places.

Summer (June to August).—Over the sea the relative humidity in July increases from north to south. At the head of the gulf it is about 50 per cent., in the Strait of Hormuz about 75 per cent., and on the Makran coast about 80 per cent. Observations, however, are very few and these figures must be treated with reserve.

On the shores of the Persian gulf the humidity in the morning is about 70 per cent.; it shows very little change from month to month. Inland the air is very dry. Basra (Shaibah) records only 20 or 25 per cent. as the normal at 0900. The increase towards the coast is very rapid. The NW. shamal wind picks up moisture as it passes southwards over the sea, and at Henjam the mean is about 75 per cent. There is a further increase eastwards along the northern shore of the Gulf of Oman from about 75 per cent. at Jask to nearly 85 per cent. at Gwadar. Muscat on the southern shore experiences a rapid increase of humidity during the season, especially between June and July, when it is affected by the SW. monsoon; the humidity increases from just over 60 per cent. in June to 80 per cent. in August, which is the most humid month of the year.

The variation of humidity between 0930 and 1530 is comparatively small on the coasts. At many places the mean values at these hours are almost identical, and nowhere do they differ by more than about 10 per cent. Inland the variation is greater.

On some occasions the air at Shaibah may be almost completely dry. On the other hand a humidity of 79 per cent. has been recorded there in July, and saturation has been reached in August.

The lower humidity and the greater diurnal variation make the intense heat more tolerable inland than on the coast. The extreme dryness has some interesting effects: drinking water put out in porous vessels in the wind at midday has been known to cool from a temperature of over 100° F. to less than 70° F. It is reported that

on board ship at Basra woodwork dries and shrinks sometimes to such an extent that the wood of the cabins breaks away from the supports and there may be cracks 3 or 4 tenths of an inch wide. Teak is said to withstand the dryness best.

On the coast, on the other hand, the humidity, coupled with high temperature, may be very trying, and many people leave the coast in summer for this reason.

Autumn (September to November).—During the autumn the humidity on the shores of the Persian gulf increases as the southerly winds associated with western depressions begin to make themselves felt, and by November the mean in the morning is between 75 and 80 per cent., inland at Basra (Shaibah) it is just over 60 per cent. In the Gulf of Oman the humidity decreases after the cessation of the southerly winds and in November the average is rather lower than in the Persian gulf, varying from about 65 per cent. in the west to just over 75 per cent. in the east.

The diurnal range varies very much from place to place, but in general the humidity in the afternoon falls below 70 per cent. and in some places to 55 per cent. or less.

On occasions the air at Shaibah may be almost completely dry; in all the autumn months humidities below 5 per cent. and above 98 per cent. have been recorded.

Diurnal variation.—The diurnal variation of relative humidity is large. Detailed information about the highest and lowest values during the day is not available for any places in the region under consideration, but the following table of average values at Basra (Shaibah) at the three hours 0500, 0900, and 1600 (Z-3) gives some idea of the variation likely to be encountered. Shaibah is some 60 miles from the open sea. At places on the coast the diurnal variation is likely to be less, and over the open sea it is probably quite small.

Basra (Shaibah)—MEAN RELATIVE HUMIDITY
Period: Mar. 1928—Feb. 1938.

Hour	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
(Z-3)	<i>per cent.</i>												
0500	91	88	75	67	55	46	34	38	44	51	76	87	63
0900	83	76	55	43	31	25	21	23	25	35	60	78	46
1600	55	45	32	27	20	17	14	14	14	20	39	53	29
Range	36	43	43	40	35	29	20	24	30	31	37	34	34

Authority.—Bibliography No. 42.

It is probable that the highest values of the twenty-four hours are recorded in the early morning, shortly before sunrise, and the lowest in the early afternoon, so that the values given in the general climatological tables do not show the extreme daily range.

Wet-bulb temperature.—Mean values of the temperature of the wet bulb, where possible for both morning and afternoon hours of observation, are included in the general climatological tables.

The wet-bulb temperature is of importance mainly because it gives an indication of the combined effect of high temperature and high humidity on human comfort. It has been estimated that when the reading of the wet-bulb thermometer is above 78° F. continuous hard physical work is impracticable. On the average in this region the wet-bulb temperature remains below this limit from November to April. In May, 78° F. is exceeded at some places on the average in the afternoon, but except at Chahbar, not in the morning. From June to September it is exceeded at nearly all places at both the morning and afternoon hours. The highest monthly mean shown in the tables is 87° F. at Bahrein in the afternoon in August. Wet-bulb readings of 85°–88° F. were recorded on ten successive days in August 1930 in a ship in the southern section of the Persian gulf. At places inland the humidity is probably much lower, and at Basra (Shaibah) the average value, even in the afternoon, does not exceed 74° F. in any month of the year.

In general the wet-bulb temperature is a few degrees higher in the afternoon than in the morning. In summer the difference is only about 3° F., but in winter is as much as 7° F.

X—MISCELLANEOUS

1—THUNDERSTORMS

The average number of days per month on which thunder has been heard at Basra (Shaibah), Bushire, Bahrein, Sharjah, Henjam, Jask, and Muscat, is given in the general climatological tables on pages 101–10. Except at Shaibah observations are available over a period of only five years, which is insufficient to give reliable values of the monthly frequencies.

Thunderstorms are by no means frequent in any part of the region. They occur mainly in the late autumn, winter, and early spring; they are very rare in summer from June to September. At the head of the Persian gulf and at Sharjah on the west of the Musandam peninsula the average number of storms per year is about ten, but in the Strait of Hormuz, the Gulf of Oman, and on the western part of the Makran coast the average is only about five or less.

From November to April thunderstorms are recorded in all parts of the region; their average frequency is only about one or two storms per month at the head of the Persian gulf and less than that in the south. These winter thunderstorms are usually associated with the passage of western depressions. The thunder sometimes occurs during the passage of the warm front or in the warm sector, but more frequently it accompanies the arrival of the main cold front or of a minor one. When the cold front is well marked the storms may be accompanied by squalls of gale force and a sudden reversal

of wind ; in mid-winter hail sometimes occurs ; in March thunder and lightning may be recorded without rainfall. At Basra thunder is said to be most frequent in the late afternoon, it may occur also at night and in the forenoon but is rare between 1200 and 1500.

Eastern depressions and Arabian sea storms may occasionally cause thundery weather on the Makran coast, especially in the transition seasons between the monsoons, namely, in October and November and possibly in April, but such occasions are very rare west of Jask, and are infrequent even between Jask and Gwadar.

At places situated in the neighbourhood of mountains, such as those in and near the Strait of Hormuz and at Muscat, thunderstorms may often be observed in the vicinity although they do not pass directly overhead.

2—DUSTSTORMS AND SANDSTORMS

Duststorms and sandstorms occur in all parts of the region and in all seasons of the year. They are most frequent during the months of June and July. It is obvious that the frequency at any place must depend partly on the nature of the country to windward and on the direction and strength of the most frequent winds.

At Basra (Shaibah) a duststorm is defined as an " obscuration due to sand or dust with a wind of Beaufort force 4 or over, causing a decrease of visibility below 1,100 yards." Using this criterion the average number of days per month with duststorms is shown in the following table :—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
	<i>days</i>												
Basra	.8	2	4	3	3	7	10	4	3	1	.4	.4	38

Authority.—Bibliography No. 34.

Period : 1929-35.

The maximum in March is related to the high frequency of thunderstorms in that month, and that in June and July to the 40-day shamal. There is said to be a high probability of dust between June 15 and 25 at the time of onset of the shamal.

Comparable data are not available for other parts of the region, but the following table which shows the average number of duststorms, without precise definition, will serve to give a general idea of the annual variation both in the Persian gulf and in the Gulf of Oman.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Bushire	0	.4	.4	.4	.2	2	1	.6	0	.2	.6	0	6
Bahrein	0	0	.8	.2	.6	3	.8	.6	.4	.2	0	0	6
Sharjah	.4	.6	.6	.2	0	2	.2	.4	0	.2	.4	0	5
Jask	.4	0	.2	0	.2	1	0	.6	0	0	.6	.2	3

Authority.—Bibliography No. 39.

Period : 5 years.

Note.—Figures for Gwadar are included in Part 4, but to make them comparable with those in the above table they ought probably to be reduced to about one quarter of values shown.

The difficulties that arise from the lack of accurate definition are illustrated by the fact that according to some authorities the average number of duststorms is between two and four times greater than that shown in the table.

In the winter, duststorms are associated chiefly with the passage of western depressions, and in the summer with the strong shamal winds. In the Gulf of Oman and on the Makran coast they may also occur in the autumn with eastern depressions. Occasionally the dust may extend up to a height of 15,000 feet, but usually even over the land it does not extend above 10,000 feet.

The duststorms of early summer which occur during the 40-day shamal often extend well over the open waters of the Persian gulf. They are more frequent on the Arabian side than on the Iranian, as winds from the land on that side can easily carry sand and dust from the Arabian desert.

According to observations in Iraq, it has been found that during the hot weather the relative frequency of duststorms at different hours of the day is related to the diurnal variation of wind speed. In the hot weather the storms very often begin about 0800 or (0900), local time, when as a result of convection a strong wind may be experienced at the surface, whilst at other times of the year they most frequently start one to three hours later. There is some evidence that the earlier the storm starts the greater will be the reduction in visibility. Over the land the storms usually cease or diminish in intensity at about 1500 local time but occasionally they persist overnight especially in March and April. In Iraq it has been found that duststorms can sometimes be forecast from the early morning upper wind observations ; it is said that if the speed of the wind at 1,000 feet is about 25 knots or more there is a great possibility of a duststorm developing a little later, and the greater the speed, the more the visibility is likely to deteriorate. This should be borne in mind when aircraft are flying in the early morning as a duststorm may occur about the time they wish to land.

One of the chief dangers of duststorms is the reduction of visibility which they cause. Observations at Basra (Shaibah) show that when a duststorm occurs the chances are about even that the visibility will be reduced below 550 yards ; in the case of severe storms it may be less than 55 yards. Usually the reduction in visibility is progressive and the first sign of a duststorm in Iraq is often an abnormal glare round the sun, but when the dust is associated with the cold fronts of depressions or with thunderstorms the reduction is often sudden, and the danger in consequence is greater. This type of storm is most likely to occur in October–November, and between March and June.

The following accounts of duststorms experienced by ships in the Gulf of Oman and the Persian gulf are of interest as some idea can be gathered from them of the severity of these storms.

The first account, from the S.S. *Barpeta*, is of a whirlwind of hot air and sand which occurred in the Gulf of Oman, near Muscat, at midnight on July 9, 1926, while the ship was on passage from Bombay to Basra. The hour of occurrence of the storm is noteworthy. The prevailing wind in the outer part of the Gulf of Oman during the month of July is south-easterly, force 2 or 3, with frequent but short-lived calms. The account is based on that given in the *Marine Observer* for July 1927.

July 9, 1926, 2000 (ship's time) or 1548 G.M.T. Position 23° 58' N., 59° 00' E.; Course N.48° E. true; Speed of ship 10.4 knots. Barometer 995 mb.; air temperature 88.1° F.; sea temperature 88° F.; wind ESE. 4; sea ESE. 2; swell SE. 2; visibility 7; cloud Ci, Cs, Cc, Cu, Sc.

The wind gradually freshened after 2000 and hauled and backed round the compass scarcely remaining in any direction for more than a few minutes until 2300, when it steadied slightly to S. force 4. At 2300 the barometer was 993 mb.; air temperature 90.6° F.; clouds of all types passed over the sky, heavy nimbus came up from the north-east and a few drops of rain fell.

At 2350 the sky was covered with cumulus, cumulonimbus and nimbus, the latter appearing in long black rolls. Barometer 992.5 mb., air temperature 92°F.

At 2355 when the ship was approximately 24° 26' N., 59° 34' E. the wind suddenly dropped to almost a calm and then blew from ENE. force 5-6, while the temperature rose to 99.2° F., i.e. 7.2° in three minutes. It seemed like the blast from a furnace and at first it was thought that the ship was on fire as a moment previously the air had been moderately cool. The air was heavily laden with sand. The wind increased rapidly to force 7 and backed to W. at midnight.

The actual whirlwind of hot air and sand lasted twenty minutes from 2355 to 0015; then the air cooled suddenly to 91°F.

The column seemed to be travelling in a south-westerly direction. It was impossible to estimate its diameter, but it certainly was not less than 5 miles, the distance the vessel ran while in it. From the change of the wind it was concluded that the whirlwind had a fast counter-clockwise movement.

At daybreak it was noticed that the vessel was covered with fine red sand, probably collected from the deserts behind the Makran coast and carried out to sea, a distance of 80 miles.

Heavy clouds covered the sky during the whole of the middle watch, after which they gradually dispersed, leaving cirrus and stratocumulus.

What was most noticeable of all was the sudden change of temperature; there was no gradual heating and cooling; from the cool air on the outskirts of the whirlwind one suddenly felt the hot blast, a line could almost have been drawn separating the air of 92°F. from the air of 99.2°F.

The second account, taken from the *Marine Observer* of September 1926, is of a sandstorm experienced by H.M.S. *Cyclamen*, at Henjam in the Persian gulf in September 1925.

On September 19, 1925, at 1705 local time, a very heavy sandstorm was experienced at Henjam. For about half an hour before this time the sky assumed a very threatening aspect, similar to heavy rain clouds though of a lighter colour.

The storm broke quite suddenly, the wind changing from a light southerly breeze, force 1, to a force of 5-6 from the eastward. The air at once became thick with sand and the visibility closed rapidly to about 150 yards. The storm lasted at this force for about 15 minutes and then the visibility became greater and the wind decreased, though there were still occasional squalls. By 1815 the wind had dropped to force 3 and the visibility cleared to about one mile. At 1900 the wind dropped and then blew from the westward.

After this storm the air became drier and at midnight the difference of the wet- and dry-bulb temperatures was 8° F. compared with 2° or 3° F. before the storm. During the evening very vivid lightning was observed.

This storm took place one day after the new moon, and the natives said that it marked the end of the hot weather for the year.

3 -SEA AND SWELL

Table VIII on page 137 shows the percentage frequency of different states of the sea in the morning and afternoon at Bushire, Bahrein, Henjam, Jask, and Muscat.

In the Persian gulf the sea gets up quickly and is short and steep. In the entrance to the gulf where the tidal stream may be opposed to a strong shamal the sea may be particularly distressing, breaking very heavily; it is often out of all proportion to the amount of wind, but quickly subsides again after a gale.

When there is a heavy shamal blowing very high seas will be experienced off Muscat, in the Gulf of Oman, and also on the Makran coast.

Seasonal variation

Winter (December to February).—The occasions when a swell is experienced in the Persian gulf in this season are usually associated with the strong squally NW. shamals that occur after the passage of the cold front of western depressions. The swell starts from the head of the gulf and travels south-eastwards faster than the cold front so that its arrival in the southern part of the gulf is a useful indication of the existence of a cold front to the north. This swell may also be felt in the Gulf of Oman and occasionally off the Makran coast. It is most likely to occur in December, January, and February. Its direction at any place depends on the direction of the shamal.

Spring (March to May).—The sea is usually smooth or slight throughout the greater part of the region. Rough seas are more frequent in the north of the Persian gulf than elsewhere.

Summer (June to August).—In the Persian gulf from about mid June to the end of July a swell may be noticed during the 40-day shamal, but is not felt much during the rest of the season.

In the Gulf of Oman and on the Makran coast the effects of the SW. monsoon are felt to some extent. From June to September a heavy monsoon swell rolls up on the Makran coast, and also passes round Ras al Hadd, and is felt off Muscat and even to a slight extent in the Strait of Hormuz. Sometimes there is a heavy swell in this strait for several hours without any wind immediately preceding or following its arrival; such a swell is usually the forerunner of a gale.

At Gwadar at this season there is a long swell from the south-south-west and along the coast to the westward its direction gradually alters round to the south-east. At Chahbar it is about south and

at Cape Jask south-east, the long ground swell causing surf on the coast in this neighbourhood. The swell is much heavier than would normally be expected from the strength of the wind, but it varies a good deal and when a break in the monsoon occurs it is light.

Autumn (September to November).—As in spring the sea is usually smooth or slight throughout the whole region. In September the effect of the SW. monsoon is still felt on the Makran coast and in the Gulf of Oman. It sometimes disappears early in September, but at other times it continues for most of the month; it always ceases by the end of the month.

Occasionally also, in this region, moderate or rough seas accompanied by a considerable swell may be experienced in association with eastern depressions. A tropical storm in the Arabian sea which has produced bad weather to the south, may cause rough seas and a heavy ground swell with much surf on the Makran coast.

The following notes of local peculiarities of sea and swell at a few places in the Persian gulf and Gulf of Oman and on the Makran coast are taken from the Persian gulf Pilot.

Kuwait harbour (29° 23' N., 47° 59' E.) situated on the Arabian coast at the head of the Persian gulf:

The shamal raises a considerable sea in the southern part of the bay, but it is insufficient to distress a large vessel though a heavy swell gets up quickly making boat-work difficult. The kaus (SE. wind) also causes a swell in the harbour much greater than would be expected from the strength of the wind.

Kangun (27° 49' N., 52° 04' E.) situated on the Iranian coast of the Persian gulf:

The shamal in this locality blows from north-westward and some swell rolls in from west-south-westward.

Jask (25° 45' N., 57° 45' E.) situated on the northern shore of the Gulf of Oman:

This bay is open to the easterly gales of winter. In a shamal the wind is westerly and a considerable swell rolls round the cape. As the bay is open to the south-eastward there is usually a light surf on the beach which becomes heavy during the SW. monsoon, although there may be only a slight ground swell in the bay.

Chahbar (25° 17' N., 60° 37' E.) situated to the west of Gwadar: During the SW. monsoon south-south-easterly winds of some strength are common by day but fall light at night. These winds cause a heavy sea to break all round the shores of the bay, except at the town, which is sheltered.

Gwadar bay (25° 13' N., 62° 28' E.).

The bay is well sheltered from south-westerly winds but during the SW. monsoon the long swell rounding Ras Nuh causes vessels at anchor to roll heavily. During easterly winds communication with the shore is sometimes difficult.

4—DEW

Dew is very heavy in the Persian gulf, especially in summer when, in the morning the sails of native craft often drip with moisture and it would appear as though there had been a heavy shower of rain.

On the Makran coast dew is heavy from March to September and occasionally during the winter.

5—WATERPOUTS AND SANDSPOUTS

Waterspouts at sea and sandspouts or dust-devils on the land are frequent in the Persian gulf, in the Gulf of Oman, and on the Makran coast.

H.M.S. *Ormonde*, when in the Strait of Hormuz, in Lat. 26° 28' N., Long. 55° 45' E. on the night of January 5-6, 1931, reported that when a squall, accompanied by heavy rain, passed over the ship the barometer rose about 2 mb. very rapidly and then dropped slowly after the storm had passed. It was thought that this squall was actually a waterspout passing over the ship. It is understood that waterspouts do occur at night as well as during the day, but that they are not often reported as they are difficult to see in the dark and must pass very close in order to be observed.

On January 7, 1931, at 0930 the same ship in the same position reported three waterspouts, bearing north-west, distant 8 miles. Two of these waterspouts appeared to be revolving round each other, and at 0937 the second spout reached down suddenly into the sea and raised large quantities of spray, the top then grew very dark and in a few seconds the whole disappeared starting from the top and disappearing downwards. Another waterspout was seen to north-west at 1100, and at 1235 the ship again reported seeing numerous waterspouts passing nearby, one being within 50 yards. On this occasion no top was visible amongst the clouds, but spray was obviously raised from the sea and was whirled round in a clockwise direction to a height of about 20-25 feet, the base of the area of disturbance was about 100 square yards.

On November 25, 1930, H.M.S. *Ormonde* when off the Makran coast in the vicinity of 25° 20' N., 59° 00' E. reported seeing dust-spouts over the land at 1130, the visibility at this time was extremely good and was reported to be about 60 miles.

6—MIRAGE

Excessive refraction and mirage are known to occur in some parts of the region. The eastern portion of the coast of Trucial Oman is remarkable for the high degree of refraction or mirage that is frequently experienced, especially in the early morning, when the features of the coast become greatly distorted, villages sometimes appearing as clumps of rounded trees, and small uncharted hillocks or dunes as hills of considerable height.

H.M.S. *Ormonde* at 0800 on January 2, 1932, when on her surveying ground in the vicinity of Sharjah, reported seeing a very fine mirage over the land; all the hills in the middle distance appeared upside down.

7—AIR TURBULENCE AND BUMPINESS

Over the Persian gulf, away from the coasts, bumps are very infrequent. They appear to be most frequent on the south-west coast of the Gulf of Oman. This is probably due to the fact that in this region the prevailing winds blow approximately at right angles to the line of hills which run roughly north to south thus causing a considerable upward movement of the air.

TABLE I—GENERAL CLIMATOLOGICAL TABLES

Basra (Shaibah). 30° 25' N., 47° 39' E., 63 ft.

Times of obs. : 0500, 1600 (Z-3).

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder	Wind										Poor visibility †	Relative humidity ‡	Cloud amount ††	Wet-bulb temperature °F.				
	Average	Daily range †	Average*	Mean of		Mean of		Extreme	Average fall	No. of days ‡	Max. fall in 24 hours		Percentage of observations from																	
				Daily max.	Daily min.	Highest	Lowest						Highest	Lowest	Speed in knots	N.	NE.	E.	SE.	S.	SW.	W.					NW.	Calm		
													Observations at 0500 (Z-3)																	
January ..	mb. 1019	mb. 2.6	°F. 52	°F. 62	°F. 42	°F. 72	°F. 30	°F. 81	°F. 21	mm. 32	in. 1.3	3	mm. 55	in. 2.2	days 0.9	6	5	6	9	10	3	5	31	19	12	1	91	3.7	43	
February ..	1016	2.5	57	67	46	79	33	85	23	31	1.2	3	36	1.4	2	6	7	3	9	13	6	7	25	13	17	1	88	2.8	47	
March ..	1014	2.4	66	79	53	91	41	102	29	10	0.4	1	18	0.7	3	5	5	6	8	12	7	8	20	13	21	0.8	75	2.6	50	
April ..	1010	2.4	75	89	61	103	50	110	44	11	0.5	1	28	1.1	2	5	5	2	7	11	9	11	21	12	22	0.4	67	2.9	57	
May ..	1007	2.1	87	101	72	111	64	115	59	2	< 1	0.2	7	0.3	2	5	7	4	2	6	6	8	11	20	17	27	0.9	55	3.0	63
June ..	1001	1.7	92	107	77	115	70	121	64	0	0.0	0	0	0.0	0.1	6	7	1	< 1	0	2	10	28	36	16	1	46	0.2	64	
July ..	997	1.7	96	111	81	117	74	120	70	0	0.0	0	0	0.0	0	7	3	0	< 1	1	1	8	44	34	9	2	34	0.7	64	
August ..	999	2.0	96	112	80	118	73	125	67	< 1	< 1	0	2	< 1	0.1	6	4	< 1	3	3	4	13	42	24	7	0.4	38	0.8	65	
September ..	1005	2.2	90	107	72	114	65	118	58	0	0.0	0	0	0.0	0	6	2	2	1	4	6	14	39	22	10	0.8	44	0.4	61	
October ..	1012	2.3	80	96	64	107	55	111	47	2	< 1	0.1	15	0.6	0.3	6	6	4	3	5	8	15	30	20	9	0.8	51	1.1	58	
November ..	1017	2.5	67	80	55	92	41	100	32	28	1.1	2	46	1.8	2	5	4	4	8	9	6	8	23	17	21	1	76	2.6	52	
December ..	1019	2.4	55	66	45	78	32	88	19	26	1.0	3	37	1.5	2	6	5	4	4	6	8	5	7	30	21	14	1	87	3.1	45
Year ..	1010	2.2	76	90	62	119	27	125	19	1.2	5.6	13	55	2.2	14	6	5	3	5	7	5	10	29	21	15	11	63	2.0	56	

Authority.—Bibliography No. 42.

Periods.—Pressure, wind (speed and direction), relative humidity, cloud amount, wet-bulb temp., Mar., 1928–Feb., 1938.
 Temperature, June, 1922–Dec., 1937.
 Rain and no. of days with thunder, 1923–37.
 Poor visibility, Mar., 1928–Nov., 1937 (omitting Mar.–Nov., 1932).

Notes.—† Mean of obs. at 0500, 0900, 1600 (Z-3).
 †† Difference between means at 0900 and 1600 (Z-3).
 ‡ (max. + min.).
 ‡‡ Day with 2.54 mm. (0.1 in.) or more of rain.
 ‡‡‡ No. of days with visibility less than 2 nautical miles.
 ‡‡‡‡ Some of the cloud in summer is due to dust.

Month	Observations at 1600 (Z-3)													
January ..	10	13	5	8	14	3	< 1	10	42	5	1	55	4.7	52
February ..	10	17	3	5	18	5	< 1	6	37	8	2	45	3.9	55
March ..	11	25	5	6	15	4	< 1	4	34	7	3	32	3.8	59
April ..	12	28	4	9	14	3	1	5	32	4	2	27	3.8	65
May ..	11	43	5	7	9	1	1	3	29	2	2	20	3.1	69
June ..	15	38	2	1	1	0	0	3	54	1	6	17	0.7	72
July ..	14	35	1	0	< 1	0	1	4	58	< 1	7	14	1.0	73
August ..	12	36	1	3	4	1	< 1	3	50	1	4	14	1.0	74
September ..	11	34	4	4	5	< 1	< 1	3	46	3	2	14	0.5	70
October ..	10	29	5	3	9	1	1	4	44	4	2	20	1.9	67
November ..	9	18	5	8	17	4	1	5	36	6	0.6	39	4.0	62
December ..	9	14	3	7	14	3	2	12	41	4	0.7	53	4.3	55
Year ..	11	27	4	5	10	2	1	5	42	4	32	29	2.7	64

Table I—General climatological tables

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TABLE I—continued

Mohammerah (Khorramshahr). 30° 28' N., 48° 18' E. 10ft. Kuwait. 29° 20' N., 48° 00' E. Height : Not known.

Month.	Air Temperature							Rain				Cloud amount	Air Temperature							Rain				Cloud amount	
	Average*	Mean of		Mean of		Extreme		Average fall	No. of days†	Max. fall in 24 hrs.	Average*		Mean of		Mean of		Extreme		Average fall	No. of days†	Max. fall in 24 hrs.				
		Daily max.	Daily min.	Highest	Lowest	Highest	Lowest						Daily max.	Daily min.	Highest	Lowest	Highest	Lowest							
																						°F.	°F.		°F.
January ..	55	64	46	72	37	76	30	30	1.2	4	24	0.9	55	60	49	70	41	82	36	27	1.1	2	25	1.0	3.9
February ..	59	68	49	75	41	81	37	37	1.4	3	24	0.9	57	64	51	71	42	78	27	16	0.6	2	28	1.1	4.0
March ..	65	75	55	83	47	87	43	40	1.6	4	27	1.1	65	71	58	82	50	89	40	25	1.0	2	27	1.1	3.1
April ..	75	86	64	91	57	93	55	11	0.4	2	23	0.9	75	83	67	96	58	100	54	4	0.2	0.7	7	0.3	2.9
May ..	85	95	74	100	67	104	65	4	0.2	0.8	5	0.2	85	95	76	106	63	109	60	3	0.1	0.5	7	0.3	2.3
June ..	90	101	79	108	73	108	70	0	0.0	0	0	0.0	89	97	81	106	76	115	73	0	0.0	0	0	0.0	0.1
July ..	92	103	82	107	76	120	73	0	0.0	0	0	0.0	93	101	85	112	79	117	78	0	0.0	0	0	0.0	0.5
August ..	93	104	81	109	76	111	74	0	0.0	0	0	0.0	94	102	85	113	78	115	68	0	0.0	0	0	0.0	0.4
September ..	88	101	76	105	—	107	67	0	0.0	0	0	0.0	90	100	80	108	74	117	67	0	0.0	0	0	0.0	0.2
October ..	81	93	69	99	64	100	59	3	0.1	0.3	10	0.4	81	90	72	100	65	105	63	5	0.2	0.1	25	1.0	1.5
November ..	69	80	58	89	52	93	49	25	1.0	2	43	1.7	69	76	62	88	52	96	46	12	0.5	1	12	0.5	2.7
December ..	57	65	48	71	41	80	37	63	2.5	5	41	1.6	58	64	51	75	43	79	36	31	1.2	3	23	0.9	4.1
Year ..	78	86	65	—	—	120	30	213	8.4	21	43	1.7	76	84	68	—	—	117	27	123	4.8	11	28	1.1	2.1

Authorities.—Bibliography Nos. 1, 42.

Periods.—Mohammerah (Khorramshahr), 5–6 years ; Kuwait, 7 years.

Time of obs. : 0800 local time.

Notes—* † (max. + min.). † Day with 2.54 mm. (0.1 in.) or more of rain.

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Persian gulf and Gulf of Oman

TABLE I—continued

Bushire. 29° 00' N., 50° 50' E. 14 ft.

Times of obs.: 0730, 1530 (Z-3½)**.

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder	Wind																
	Average†	Daily range	Average*	Mean of		Extreme		Average fall	No. of days‡	Max. fall in 24 hours	Percentage of observations from																		
				Daily max.	Daily min.	Highest	Lowest				Highest		Lowest	Speed in knots	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Poor visibility‡	Relative humidity%	Cloud amount	Wet-bulb temperature °F.		
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	mm.	in.	days	mm.	in.	days	Observations at 0730 (Z-3½)										† 0730				
January ..	1019		57	64	51	74	43	80	32	73	2.9	5	140	5.5	0.6	5	40	31	16	5	0	1	0	7	0	1	87	4.5	52
February ..	1017		59	65	53	76	45	85	37	46	1.8	5	85	3.3	0.2	5	29	25	15	12	1	2	4	11	1	3	81	4.0	55
March ..	1015		66	73	59	87	51	105	42	21	0.8	5	68	2.6	0.6	5	25	29	18	9	3	1	3	11	1	0.4	75	4.1	58
April ..	1011		74	81	67	95	59	103	47	11	0.4	2	38	1.5	0.6	6	26	21	14	10	5	1	1	21	1	2	67	3.3	65
May ..	1008		83	89	76	100	67	107	58	1	< 0.1	0	14	0.6	0.4	6	22	12	13	4	5	0	6	34	4	0.8	67	2.2	73
June ..	1001		87	92	81	101	74	112	67	0	0.0	0	0	0.0	0	7	21	5	5	7	5	6	3	45	3	3	69	0.2	76
July ..	997	Data not available	89	95	84	102	78	112	74	0	0.0	0	0	0.0	0	5	15	6	5	5	12	2	8	34	13	4	73	0.8	81
August ..	1000		91	97	84	104	78	115	69	0	0.0	0	5	0.2	0	5	17	13	18	15	5	2	2	19	9	1	68	1.0	81
September ..	1008		87	94	79	100	73	107	63	0	0.0	0	0	0.0	0	4	18	19	12	12	4	4	8	10	13	0	67	0.6	77
October ..	1013		80	88	72	94	65	101	55	3	0.1	0.2	44	1.7	0	4	20	32	17	7	4	1	3	10	6	1	69	1.0	70
November ..	1016		71	78	63	87	54	93	42	41	1.6	3	73	2.9	1	4	23	33	25	12	1	0	1	4	1	0	73	2.6	63
December ..	1019		61	68	55	78	46	87	37	80	3.1	4	135	5.3	0.4	4	35	31	23	6	0	0	0	4	< 1	0.4	80	4.7	55
Year ..	1010		75	82	69	106	42	115	32	27½	10.9	18	140	5.5	4	5	24	22	15	9	4	2	3	17	4	16	73	2.4	67

Authorities.—Bibliography Nos. 1, 20, 37, 39, 42.
 Periods.—Pressure (Apr.–Oct.), 32 years; (Nov.–Mar.), 15 years.
 Temp. and rain, 53 years (mean highest and lowest temp. of year 34–5 years only).
 No. of days with thunder, wind (direction), and poor visibility, 1933–7.
 Wind (speed), 1876–99.
 Relative humidity and wet bulb temp., July, 1934–June, 1938.
 Cloud amount (Apr.–Oct.), 25 years; (Nov.–Mar.), 15 years.

Notes.—** 1730 (Z-3½) before July, 1934.
 † Obs. at 0800 (local time) Apr. to Oct., and at 0700, Nov. to Mar.
 * † (max. + min.).
 ‡ Day with 2.54 mm. (0.1 in.), or more of rain.
 †† Mean of 24 hours.
 ††† No. of days with visibility less than 2 nautical miles.

Month	Observations at 1530 (Z-3½)**											
January ..	11	5	3	8	7	3	5	58	0	0.2	77	59
February ..	10	2	3	13	6	3	11	52	0	2	73	60
March ..	3	1	< 1	8	8	8	23	48	0	0.4	68	63
April ..	5	1	< 1	3	8	11	25	46	0	0.8	65	69
May ..	1	1	< 1	1	2	9	29	58	0	0.8	68	77
June ..	3	0	0	0	3	13	46	35	0	1	68	80
July ..	4	0	0	0	6	19	47	24	0	4	70	84
August ..	2	0	< 1	1	10	24	41	21	0	1	67	85
September ..	1	0	0	0	3	15	43	38	0	0.2	64	82
October ..	5	0	< 1	1	4	10	35	44	0	0.2	65	77
November ..	8	3	5	7	4	5	17	51	< 1	0.2	67	69
December ..	17	1	4	5	8	3	6	55	< 1	0.2	75	62
Year ..	6	1	2	4	6	10	27	44	< 1	11	69	72

Table I—General climatological tables 3 103

TABLE I—continued

Sharjah. 25° 20' N., 55° 24' E. 18 ft.

Times of obs. : 0800, 1600 (Z-4)**.

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder	Wind											Poor visibility †	Relative humidity%	Cloud amount	Wet-bulb temperature °F.		
	Average†	Daily range	Average*	Mean of		Mean of		Extreme		Average fall	No. of days‡		Max. fall in 24 hours	Speed in knots	Percentage of observations from														
				Daily max.	Daily min.	Highest	Lowest	Highest	Lowest						N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm						
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	mm.	in.	days	mm.	in.	days	Observations at 0800 (Z-4)														
January ..	1019	63	73	52	80	43	82	37	15	0.6	1	21	0.8	0.2	7	<1	5	12	42	20	3	10	4	4	0.3	77	4.3	54	
February ..	1015	65	75	56	85	48	91	46	33	1.3	2	24	2.9	1	7	<1	3	8	30	34	2	15	3	2	77	3.9	56		
March ..	1014	69	79	58	95	49	101	46	17	0.7	1	18	0.7	0.8	7	<1	3	5	28	35	2	9	2	16	71	3.2	59		
April ..	1010	75	86	65	99	57	103	55	<1	<0.1	0.3	3	0.1	2	7	<3	3	3	18	45	6	6	0	16	60	1.8	64		
May ..	1005	83	93	73	103	66	108	63	0	0.0	0	0	0.0	1	7	<1	2	2	15	52	11	4	1	12	0.6	55	1.7	71	
June ..	1000	86	95	76	106	68	112	67	0	0.0	0	0	0.0	0	7	<0	2	1	10	63	10	1	0	13	2	63	0.9	76	
July ..	997	Data not available	99	81	111	75	112	74	0	0.0	0	0	0.0	0	6	<1	2	5	22	42	8	<1	<1	19	6	60	1.7	78	
August ..	999	93	102	83	110	77	113	74	0	0.0	0	0	0.0	0	7	<1	3	12	32	36	4	3	0	10	2	61	1.6	79	
September ..	1005	87	98	77	107	71	112	69	0	0.0	0	0	0.0	0.6	6	<1	2	5	27	46	3	1	0	15	1	67	1.0	76	
October ..	1012	81	92	71	100	65	102	64	0	0.0	0	0	0.0	1	5	<1	2	4	28	40	5	<1	<1	19	2	75	1.1	71	
November ..	1016	75	86	63	93	57	94	55	23	0.9	0.4	108	4.3	1	5	<1	1	10	45	37	0	3	0	3	0.2	75	2.7	63	
December ..	1017	68	78	59	84	52	86	49	29	1.1	2	29	1.1	2	5	<1	3	7	39	34	<1	5	4	7	0.6	81	3.9	59	
Year ..	1009		78	88	68	112	43	113	37	117	4.6	7	108	4.3	10	6	<1	3	6	28	40	5	5	1	11	20	69	2.3	67

Authorities.—Bibliography Nos. 37, 39.

Periods.—Pressure, temp., rain, no. of days with thunder, poor visibility, 1933-7.

Wind (speed and direction), June, 1933-May, 1938.

Relative humidity, cloud, wet-bulb temp., July, 1934-June, 1938.

Notes.—** 1800 (Z-4) before July, 1934.

† Corrected to mean of 24 hours.

* † (max. + min.).

‡ Day with 2.54 mm. (0.1 in.) or more of rain.

†† Mean of 24 hours.

‡ No. of days with visibility less than 2 nautical miles.

Month	Observations at 1600 (Z-4)**												
January ..	23	3	<1	0	1	7	35	30	0	0.6	54	4.1	61
February ..	19	5	2	0	3	8	41	22	0	2	58	3.4	63
March ..	17	3	3	2	<1	8	35	32	0	0	56	2.8	66
April ..	14	5	1	0	0	11	39	31	0	2	56	2.0	70
May ..	6	<1	0	0	0	10	53	30	0	0.6	57	1.6	76
June ..	9	<1	0	0	<1	18	42	29	<1	2	63	0.5	82
July ..	22	<1	<1	<1	0	7	25	44	0	7	59	1.1	83
August ..	26	3	2	<1	0	2	18	48	0	2	58	1.0	84
September ..	19	<1	0	0	0	0	23	57	0	0.4	58	0.4	82
October ..	10	5	2	<1	1	1	27	48	5	0.2	57	1.1	77
November ..	12	2	1	<1	<1	3	30	49	<1	0.4	54	3.1	71
December ..	16	2	<1	1	3	9	34	34	0	0	58	3.7	65
Year ..	16	3	1	<1	<1	7	33	38	<1	17	57	2.1	73

Table I—General climatological tables

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TABLE I—continued

Henjam. 26° 40' N., 55° 55' E. 100 ft.

Times of obs.: 0800, 1600 (Z-4)**

Month	Pressure at M.S.L.		Air Temperature						Rain				Wind																
	Average	Daily range	Average*	Mean of		Mean of		Extreme	Average fall	No of days†	Max. fall in 24 hours	Thunder	Speed in knots	Percentage of observations from								Poor visibility †	Relative humidity%	Cloud amount	Wet-bulb temperature †				
				Daily	Daily	Highest	Lowest							Highest	Lowest	N.	NE.	E.	SE.	S.	SW.					W.	NW.	Calm	
January ..	1018	65	71	60	77	52	82	48	22	0.9	1	40	1.6	0	6	35	37	4	0	1	3	5	11	4	0.9	70	3.7	58	
February ..	1016	67	73	61	81	53	88	49	38	1.5	2	55	2.2	0.7	6	32	28	2	1	0	8	4	17	8	2	81	3.1	61	
March ..	1013	72	78	66	88	58	93	47	18	0.7	1	38	1.5	1	5	14	28	6	2	2	17	7	7	17	0.6	77	2.8	66	
April ..	1010	78	85	71	95	85	99	60	15	0.6	0.9	59	2.3	2	6	6	13	9	4	3	33	7	11	14	1	76	3.0	72	
May ..	1006	84	92	77	99	72	104	69	0	0.0	0	0	0.0	0.3	7	2	6	8	3	2	44	12	5	18	2	74	1.3	77	
June ..	999	88	95	81	104	76	107	68	0	0.0	0	0	0.0	0	6	3	11	9	3	1	38	12	5	18	7	79	1.2	81	
July ..	997	Data not available	91	97	85	105	79	107	63	0	0.0	0	< 1	> 1	0	5	3	24	16	5	3	21	7	3	18	7	75	1.9	84
August ..	999	Data not available	91	97	85	103	83	106	81	0	0.0	0	0	0.0	0	6	5	38	29	3	2	7	4	2	10	3	76	1.8	84
September ..	1005	Data not available	89	95	83	102	79	105	77	0	0.0	0	0	0.0	0	5	9	27	23	6	< 1	9	4	5	17	0.3	76	1.3	82
October ..	1011	Data not available	85	91	78	97	73	99	70	< 1	< 1	0.1	3	0.1	0.3	5	21	46	10	1	1	6	2	2	11	0.3	75	1.2	77
November ..	1016	Data not available	77	83	70	89	64	92	60	3	0.1	0.3	9	0.3	1	4	44	39	1	1	0	1	7	6	0.3	74	2.0	69	
December ..	1017	Data not available	69	75	63	81	57	84	50	30	1.2	2	43	1.7	0.7	5	38	37	3	< 1	0	2	5	10	5	0.6	74	3.4	61
Year ..	1009	80	86	73	105	51	107	47	126	5.0	7	59	2.3	6	5	18	28	10	2	1	16	6	7	12	25	76	2.2	73	

Authorities.—Bibliography Nos. 37, 39.

Periods.—Pressure, 5 years.

Temp., rain, relative humidity and cloud amount, 1927-35.

No. of days with thunder, poor visibility, 1933-5.

Wind (speed) and wet-bulb-temp., 1928-35.

Wind (direction), 1930-5.

Notes.—** 1800 (Z-4) before July 1934.

† Corrected to mean of 24 hours.

* (max. + min.).

‡ Day with 2.54 mm. (0.1 in.) or more of rain.

†† Mean of 24 hours.

‡ No. of days with visibility less than 2 nautical miles.

Month	Observations at 1600 (Z-4)**																
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year	Poor visibility †	Relative humidity%	Cloud amount	Wet-bulb temperature †
January ..	2	22	12	3	4	35	11	4	7	0.7							
February ..	1	12	6	4	2	53	13	1	8	2							
March ..	1	5	6	10	3	54	14	2	5	1							
April ..	2	2	4	4	3	65	16	< 1	3	2							
May ..	< 1	0	< 1	2	3	77	15	0	2	5							
June ..	< 1	< 1	1	2	2	72	15	< 1	6	4							
July ..	1	2	14	12	3	44	17	2	5	7							
August ..	1	4	20	18	3	38	11	< 1	6	5							
September ..	< 1	0	4	14	2	53	22	1	4	0.3							
October ..	0	2	9	11	< 1	53	17	0	7	0							
November ..	< 1	2	8	10	3	52	15	2	7	0.3							
December ..	3	16	12	9	2	38	10	1	9	0							
Year ..	1	6	8	8	2	53	15	1	6	24							

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Persian gulf and Gulf of Oman

TABLE I—continued

Jask. 25° 45' N., 57° 45' E. 13 ft.

Times of obs.: 0800, 1600 (Z-4)**.

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder	Wind										Poor visibility †	Relative humidity %	Cloud amount	Wet-bulb temperature °F.			
	Average†	Daily range	Average*	Mean of		Mean of		Extreme		Average fall	No. of days‡		Max. fall in 24 hours	Percentage of observations from															
				Daily max.	Daily min.	Highest	Lowest	Highest	Lowest					N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm							
January ..	1019	mb.	67	74	60	79	52	85	42	31	1-2	2	69	2-7	0-8	7	48	18	10	3	0	0	3	14	6	0-6	67	2-8	57
February ..	1017	mb.	69	75	62	81	55	88	47	22	0-9	2	49	1-9	1	7	18	16	10	4	0	1	13	33	5	1	76	2-8	61
March ..	1014	mb.	74	81	67	88	59	93	47	16	0-6	1	83	3-3	1	7	23	15	13	5	1	1	12	24	7	0-6	69	2-4	64
April ..	1010	mb.	80	87	73	94	66	102	60	5	0-2	0-5	36	1-4	0-4	7	10	10	19	8	1	2	21	21	8	3	28	1-6	70
May ..	1008	mb.	85	93	78	101	72	110	65	0	0-0	0	6	0-2	0	7	5	8	25	5	2	3	27	13	12	0-6	66	0-5	78
June ..	1009	mb.	90	97	83	105	78	113	73	1	<1	0-1	18	0-7	0-2	7	1	10	38	18	0	1	12	13	7	2	71	1-1	81
July ..	998	mb.	91	97	85	104	81	112	76	1	<1	0	18	0-7	0	8	1	7	62	15	2	1	5	6	2	2	74	2-0	83
August ..	1001	mb.	89	95	84	103	80	110	74	0	0-0	0	5	0-2	0	8	1	5	58	26	2	1	4	2	2	0	74	2-8	81
September ..	1006	mb.	87	93	81	101	76	107	70	0	0-0	0	0	0-0	0	7	10	10	40	18	1	1	0	7	13	0-2	66	1-5	78
October ..	1013	mb.	83	91	75	98	69	103	64	4	0-2	0-3	34	1-3	0-2	7	6	3	9	36	11	0	9	11	21	1	67	0-9	73
November ..	1017	mb.	78	84	68	90	62	94	52	8	0-3	0-6	42	1-7	0-6	5	33	20	11	5	1	0	5	13	12	0-2	64	1-9	66
December ..	1019	mb.	71	78	63	83	57	88	46	31	1-2	2	59	2-3	1	6	45	20	7	0	0	0	9	16	3	0	67	2-6	61
Year ..	1010	mb.	80	87	73	106	51	113	42	119	4-7	9	83	3-3	5	7	16	12	28	10	<1	<1	10	14	8	11	69	1-9	71

Month	Observations at 1600 (Z-4)**											
January ..	3	1	7	12	13	13	29	18	4	0-4	58	63
February ..	2	2	5	12	7	15	38	19	<1	1	66	66
March ..	2	4	12	13	18	29	20	0	0-4	61	69	
April ..	<1	2	7	12	19	31	26	2	2	63	74	
May ..	0	0	5	15	22	38	18	2	0-2	62	79	
June ..	0	0	<1	17	15	19	25	23	0	3	63	83
July ..	<1	0	<1	39	35	7	10	8	0	2	66	84
August ..	0	0	3	46	31	10	6	4	0-4	68	83	
September ..	0	0	1	19	19	26	23	11	1	0-8	63	81
October ..	<1	<1	<1	19	16	29	23	10	1	0-4	62	77
November ..	0	0	1	10	22	18	30	18	1	0-4	59	71
December ..	3	3	3	9	21	18	35	7	1	0-4	57	66
Year ..	<1	<1	2	17	18	18	27	15	1	11	62	75

Authorities.—Bibliography Nos. 1, 20, 37, 39, 42.

Periods.—Pressure and cloud amount, 17 years.

Temp. and rain, 38 years.

No. of days with thunder, poor visibility, wind (direction), 1933-7.

Wind (speed), 1910-30.

Relative humidity and wet-bulb temp., July, 1934-June, 1938.

Notes.—* 1800 (Z-4) before July, 1934.

† Observations at 0700 local time.

‡ (max. + min.).

‡ Day with 2-54 mm. (0-1 in.) or more of rain.

†† Mean of 24 hours.

‡ No. of days with visibility less than 2 nautical miles.

Table I—General climatological tables

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TABLE I—continued

Chahbar. 25° 17' N., 60° 37' E. 26 ft.

Times of obs.: 0800, 1600 (Z-4)**

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder	Wind										Poor visibility †	Relative humidity %	Cloud amount	Wet-bulb temperature °F.			
	Average†	Daily range	Average*	Mean of		Mean of		Extreme		Average fall	No. of days†		Max. fall in 24 hours	Speed in knots	Percentage of observations from														
				Daily max.	Daily min.	Highest	Lowest	Highest	Lowest						N.	NE.	E.	SE.	S.	SW.	W.	NW.					Calm		
January ..	1019	mb.	86	74	58	80	48	85	41	58	2.2	2	75	3.0	6	Observations at 0800 (Z-4)													
February ..	1016	mb.	69	76	61	82	52	86	45	16	0.6	1	30	1.2	6	7	31	31	2	1	1	4	14	27	10	10	71	2.9	58
March ..	1014	mb.	74	81	66	89	57	94	51	8	0.3	0.5	49	1.9	6	8	18	18	5	1	1	12	25	16	16	75	1.5	66	
April ..	1010	mb.	79	87	72	94	65	97	61	3	0.1	0.4	10	0.4	5	5	8	12	7	1	2	23	27	17	17	75	1.1	73	
May ..	1006	mb.	85	91	78	99	72	103	70	0	0.0	0	0	0.0	5	2	1	12	13	5	7	22	25	13	13	75	0.8	79	
June ..	1000	mb.	87	93	82	98	78	101	75	1	0.1	0.2	7	0.3	6	1	7	29	25	9	5	6	6	6	12	78	1.5	82	
July ..	998	mb.	87	91	83	96	79	112	77	4	0.2	0.4	12	0.5	7	0	10	42	25	10	2	1	2	8	8	Data not available	77	3.5	81
August ..	1002	mb.	83	88	80	94	76	102	73	0	0.0	0	0	0.0	7	0	8	49	29	6	1	1	2	14	4	Data not available	75	4.3	79
September ..	1007	mb.	83	88	77	96	72	104	69	0	0.0	0	0	0.0	5	0	12	32	23	5	2	7	1	4	4	Data not available	75	2.5	78
October ..	1012	mb.	81	88	73	97	65	99	59	0	0.0	0	0	0.0	4	2	17	26	9	5	1	6	13	20	20	74	0.8	75	
November ..	1017	mb.	75	84	66	92	59	96	57	3	0.1	0.5	11	0.4	5	5	26	28	3	1	1	3	18	15	15	69	1.0	69	
December ..	1019	mb.	70	78	63	84	53	87	46	30	1.2	2	69	2.7	5	7	27	30	3	0	0	3	16	14	14	68	1.6	63	
Year ..	1010	mb.	78	85	71	102	48	112	41	121	4.8	7	75	3.0	6	3	15	28	12	4	2	8	15	13	13	75	2.0	72	

Authority.—Bibliography No. 37.

Periods.—Pressure, temp., rain and cloud amount, 1928-37.

Wind (speed and direction), 1932-7.

Relative humidity and wet bulb temp., July, 1934-June, 1938.

Notes.—** 1800 (Z-4) before July, 1934.

† Observations at 0800 (Z-4).

* ‡ (max. + min.).

‡ Day with 2.54 mm. (0.1 in.) or more of rain.

†† Mean of 24 hours.

Month	Observations at 1600 (Z-4)**										Poor visibility †	Relative humidity %	Cloud amount	Wet-bulb temperature °F.
Month	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Thunder				
January ..	2	4	9	13	13	20	21	13	5		64	2.4	64	
February ..	4	2	3	6	16	20	31	17	1		73	2.0	68	
March ..	2	1	3	9	24	32	23	5	1		69	1.4	71	
April ..	0	1	1	5	27	27	30	8	1		73	1.3	77	
May ..	1	1	0	9	24	31	27	7	1		75	0.7	82	
June ..	0	0	2	17	37	28	13	1	2		77	0.4	85	
July ..	0	0	8	34	39	15	4	0	0		Data not available	78	2.0	83
August ..	0	0	11	38	33	16	1	1	0		76	1.8	81	
September ..	0	0	2	18	38	33	9	1	0		77	0.6	80	
October ..	0	1	1	8	29	39	19	2	2		75	0.2	79	
November ..	0	1	1	6	23	35	28	6	1		70	0.8	74	
December ..	4	4	8	8	17	25	24	9	1		63	1.4	67	
Year ..	1	1	4	14	27	27	19	6	1		73	1.3	78	

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Persian gulf and Gulf of Oman

TABLE I—continued

Gwadar. 25° 07' N., 62° 19' E. 22 ft.

Times of obs. : 0800, 1600 (Z-4)**

Month	Pressure at M.S.L.		Air Temperature						Rain			Thunder	Wind										Poor visibility	Relative humidity %	Cloud amount	Wet-bulb temperature °F.	
	Average	Daily range	Average*	Mean of		Mean of		Extreme		Average fall	No. of days†		Max. fall in 24 hours	Speed in knots	Percentage of observations from												
				Daily max.	Daily min.	Highest	Lowest	Highest	Lowest						N.	NE.	E.	SE.	S.	SW.	W.	NW.					Calm
January ..	1018	mb.	65	73	57	79	45	86	39	38	1.5	2	60	2.4	5	22	15	9	2	2	1	10	21	19	77	4.1	59
February ..	1015	mb.	69	77	61	84	50	91	41	31	1.2	2	64	2.5	6	16	13	7	2	1	4	23	18	16	83	3.8	64
March ..	1013	mb.	75	83	66	91	56	95	49	15	0.6	0.6	67	2.6	6	11	10	11	4	1	6	31	15	11	80	3.0	68
April ..	1010	mb.	81	89	73	99	65	104	59	8	0.3	0.1	84	3.3	7	2	6	10	5	2	13	47	7	8	80	3.0	74
May ..	1035	mb.	86	94	78	105	72	112	67	0	0.0	0	0	0.0	7	1	10	15	4	1	18	41	4	6	83	2.8	79
June ..	1040	mb.	87	93	81	102	76	110	74	1	1.1	0.1	8	0.3	5	1	11	24	13	7	14	23	1	6	83	4.3	81
July ..	998	Data not available	85	90	81	98	78	106	75	7	0.3	0.5	36	1.4	5	1	16	25	18	13	11	9	1	6	83	7.3	80
August ..	1002	Data not available	82	87	77	93	73	101	71	0	0.0	0	0	0.0	5	1	13	24	23	12	15	8	1	4	85	8.4	78
September ..	1006	Data not available	81	88	75	98	70	103	68	0	0.0	0	0	0.0	5	1	16	14	11	4	14	29	4	7	86	6.2	76
October ..	1012	Data not available	80	89	71	95	63	97	58	0	0.0	0	0	0.0	5	4	9	8	7	2	12	33	10	15	82	3.3	73
November ..	1016	Data not available	74	84	65	91	58	95	55	4	0.2	0.5	17	0.7	4	8	6	6	1	1	4	24	19	31	77	2.6	68
December ..	1017	Data not available	69	77	61	84	51	87	44	59	2.3	2	135	5.3	4	19	12	6	3	2	2	15	18	23	83	3.6	64
Year ..	1009		78	85	71	106	44	112	39	163	6.4	8	135	5.3	5	7	11	13	8	4	10	24	10	13	82	4.3	72

Authority.—Bibliography No. 37.

Periods.—Pressure, temp., rain, cloud amount, 1928-37.

Wind (direction and speed), 1930-7.

Relative humidity and wet bulb temp., July, 1934-June, 1938. The period is too short to give a reliable normal.

Notes.—** Observations at 1800 (Z-4) before July, 1934.

† Observations at 0800 (Z-4).

* $\frac{1}{2}$ (max. + min.).

‡ Day with 2.54 mm. (0.1 in.) or more of rain.

†† Mean of 24 hours.

Month	Observations at 1600 (Z-4)**										Poor visibility	Relative humidity %	Cloud amount	Wet-bulb temperature °F.
Month	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	Thunder				
January ..	6	2	12	14	13	22	12	4	15	64	63			
February ..	1	3	6	13	14	40	18	1	4	69	67			
March ..	1	0	3	6	22	51	13	2	2	65	71			
April ..	1	1	1	5	16	57	18	1	1	60	75			
May ..	1	1	1	3	23	57	15	1	1	65	80			
June ..	0	1	2	14	33	42	7	0	1	74	83			
July ..	0	1	3	24	44	24	4	0	0	76	82			
August ..	0	0	1	20	44	30	4	0	1	81	80			
September ..	0	0	0	7	33	49	10	1	1	78	79			
October ..	1	2	4	8	26	44	14	1	1	67	77			
November ..	0	1	5	12	20	39	11	1	11	64	72			
December ..	5	5	8	10	18	31	11	2	10	71	69			
Year ..	1	1	4	11	26	40	12	1	4	69	75			

Table I—General climatological tables

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TABLE II—MONTHLY FREQUENCY OF WIND DIRECTION AND FORCE AT SEA

Number of occasions per 100 on which particular winds may be expected

I = Beaufort force 1-3. II = force 4-7. III = force 8-12.

25°-30° N., 45°-50° E.†

Month	N.			NE.			E.			SE.			S.			SW.			W.			NW.			Calm	Totals of			No. of obs.
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III		I	II	III	
January	7	4	0	.9	1	0	8	.9	0	16	7	.9	5	.9	0	.9	2	0	2	.4	0	24	16	0	3	64	32	.9	108
February	11	4	0	5	0	0	3	3	0	12	6	0	12	1	0	2	0	0	3	1	0	9	18	0	9	57	34	0	47
March	19	4	0	9	2	0	5	0	0	14	0	0	2	0	0	7	0	0	4	0	0	17	6	0	10	77	13	0	48
April	6	0	0	23	0	0	4	0	0	6	0	0	6	0	0	8	0	0	4	0	0	13	4	0	25	71	4	0	24
May	13	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	58	0	0	33	67	0	12
June	13	3	0	8	0	0	0	0	0	0	0	0	0	0	0	5	0	0	8	3	0	18	37	0	5	53	42	0	19
July	0	0	0	0	0	0	2	0	0	15	0	0	0	0	0	10	0	0	2	2	0	13	40	0	17	41	42	0	24
August	7	0	0	0	0	0	0	0	0	No observations			0	0	0	3	0	0	13	0	0	43	27	0	7	66	27	0	15
September	8	4	0	0	0	0	0	0	0	12	0	0	4	0	0	0	0	0	13	4	0	33	8	0	14	70	16	0	37
October	12	5	0	3	0	0	2	0	0	12	0	0	2	0	0	5	0	0	1	1	0	33	8	0	16	70	14	0	43
November	14	12	0	3	.8	0	3	.9	0	6	0	0	.8	0	0	3	0	0	9	.8	0	30	15	0	0	71	29	0	58
December	14	12	0	3	.8	0	3	.9	0	6	0	0	.8	0	0	3	0	0	9	.8	0	30	15	0	0	71	29	0	58

25°-30° N., 50°-55° E.

January	8	10	0	6	.2	0	7	2	0	11	3	0	5	2	.4	3	1	.2	3	4	0	11	15	1	9	53	36	2	309
February	8	5	0	4	.9	0	8	2	0	7	3	0	4	2	0	3	.3	0	10	3	0	17	13	0	8	61	31	0	426
March	9	6	0	4	.9	0	7	3	0	12	3	0	7	.8	0	3	.5	.1	9	3	.2	14	8	0	9	66	25	.3	388
April	8	4	.2	5	.3	0	8	.3	0	8	.8	0	4	.1	0	6	.3	0	13	4	0	20	9	.1	9	71	20	.3	361
May	10	3	.6	2	0	0	3	0	0	3	0	0	5	0	0	5	.6	0	17	3	0	22	11	0	16	66	17	.6	318
June	12	3	0	2	0	0	3	0	0	4	0	0	5	0	0	6	0	0	19	.9	0	27	7	0	10	79	11	0	275
July	9	2	.2	5	0	0	7	.4	0	7	.2	0	8	.1	0	9	.2	0	13	.9	0	19	4	.8	16	76	7	1	308
August	8	4	0	5	1	0	10	.5	0	8	2	0	7	0	0	8	.8	0	15	3	0	11	7	0	10	71	19	0	184
September	14	5	0	3	0	0	2	.2	0	5	.9	0	7	0	0	7	0	0	20	1	0	18	7	0	11	75	14	0	192
October	14	3	0	4	.6	0	4	.6	0	4	1	0	3	.2	0	4	.6	0	15	2	0	23	8	0	13	70	17	0	245
November	15	4	0	5	.4	0	5	.9	0	8	.7	0	4	.3	0	4	0	0	9	2	0	23	11	.4	7	74	19	.4	498
December	14	5	.1	7	.9	0	6	.3	0	4	3	.3	4	3	.3	2	.5	.2	5	4	.1	19	13	1	8	61	29	2	398

Authorities.—Bibliography Nos. 2 and 42.

† The number of observations is not sufficient to give a reliable normal.

Table II—Wind direction and force at sea

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TABLE II—continued
 Number of occasions per 100 on which particular winds may be expected
 I = Beaufort force 1-3. II = force 4-7. III = force 8-12

25°-30° N., 55°-60° E.

Month	N.			NE.			E.			SE.			S.			SW.			W.			NW.			Calm	Totals of			No. of obs.
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III		I	II	III	
January	8	1	0	11	1	0	4	-6	0	11	-3	0	6	-3	0	3	3	0	11	7	-6	13	6	0	14	66	19	-6	160
February	9	2	0	9	2	0	7	-9	0	11	1	0	7	-9	0	9	3	0	10	6	-3	12	3	0	8	74	18	-3	293
March ..	6	1	0	7	-4	0	8	1	0	7	-2	0	7	-3	0	13	3	0	11	2	-2	16	3	-2	13	76	11	-4	259
April ..	7	1	0	5	-9	0	8	0	0	12	0	0	10	2	0	15	4	0	13	4	0	8	-3	0	10	79	12	0	207
May ..	4	0	0	4	0	0	8	0	0	9	-2	0	10	2	0	18	3	0	13	2	0	12	-5	0	15	76	9	0	214
June ..	8	-9	0	3	1	0	7	-8	0	15	2	0	15	-8	0	14	2	0	8	-5	0	6	1	0	15	76	9	0	182
July ..	6	0	0	4	1	0	12	2	0	19	6	0	16	5	0	10	1	0	7	-2	0	4	-3	0	7	77	16	0	197
August ..	4	-7	0	5	1	0	10	4	0	17	7	0	11	2	0	10	-7	0	7	-3	0	6	-5	0	12	71	17	0	194
September	7	-3	0	5	0	0	7	-3	0	11	4	0	14	-9	0	15	0	0	14	-3	0	9	-7	0	12	81	7	0	162
October..	12	0	0	6	-8	0	1	-5	0	5	-3	0	8	-3	0	9	2	0	15	1	0	15	-5	0	23	72	5	0	190
November	8	-4	0	6	-6	0	9	-6	0	13	-2	0	10	-2	0	10	-4	0	14	2	-2	11	2	-2	13	81	6	-4	250
December	11	1	0	7	2	0	9	2	0	7	0	0	6	-3	0	7	2	0	10	3	0	13	4	0	13	71	16	0	187

20°-25° N., 55°-60° E.

January	9	4	0	6	1	0	7	-8	0	9	5	0	5	-9	0	3	-2	0	5	5	0	14	7	0	17	59	24	0	179
February	9	3	0	9	2	0	10	3	0	15	2	0	6	2	0	3	-8	0	4	3	0	13	6	0	10	69	21	0	248
March ..	8	-9	-3	9	0	0	4	0	0	9	0	0	8	-7	0	8	-9	0	9	4	0	17	6	1	14	73	12	1	207
April ..	5	1	0	3	-1	0	4	-2	0	17	-3	0	17	2	0	15	2	0	7	2	0	9	3	0	14	76	10	0	323
May ..	4	0	0	4	-5	0	6	0	0	14	-1	0	15	5	0	17	6	-3	10	-7	0	7	-8	0	8	78	14	-3	443
June ..	5	-3	0	5	-7	0	13	-9	0	20	3	0	13	3	0	9	3	0	4	0	0	8	0	-0	13	76	11	0	285
July ..	5	-2	0	10	-3	0	16	-6	0	30	2	0	8	4	0	6	2	0	2	0	0	2	0	0	12	79	9	0	223
August ..	5	-7	0	9	-7	0	17	2	0	27	2	0	15	1	0	3	1	0	3	0	0	1	-2	0	11	80	9	0	226
September	8	0	0	9	0	0	6	0	0	16	2	0	15	4	0	13	4	0	4	-2	0	8	0	0	11	79	10	0	251
October	10	0	0	4	0	0	7	0	0	12	2	0	7	1	0	10	-2	0	11	-3	0	18	0	0	16	80	4	0	232
November	6	-8	-2	10	7	-3	9	1	0	15	1	0	6	0	0	8	1	0	5	-5	0	15	2	0	12	74	14	-5	225
December	11	3	0	14	-3	0	7	0	0	4	0	0	5	0	0	5	-6	0	11	1	0	23	5	0	12	78	10	0	171

Authorities.—Bibliography Nos. 2 and 42.
 Note.—A table for the area 20°-25° N., 60°-65° E. is given in Part 4.

TABLE III—MONTHLY FREQUENCY OF WIND DIRECTION AND OF WIND FORCE AND MEAN WIND SPEED

Number of occasions per 100 on which particular winds may be expected

Fao (control vessel *Alert*)*. 29° 55' N., 48° 39' E.

Period: Nov. 1933–Oct. 1938

	0800										1600																	
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	Beaufort force 1-3, 4-5, 6-7, 8-12				Mean speed	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	Beaufort force 1-3, 4-5, 6-7, 8-12				Mean speed
January..	9	8	9	9	1	1	4	54	5	85	10	0	0	knots	4	9	7	11	5	5	3	50	6	81	12	1	0	5
February..	8	3	6	13	3	3	6	50	8	79	12	1	0	5	8	2	7	21	8	8	5	34	7	73	19	1	0	5
March ..	10	4	6	16	3	1	3	42	15	74	10	1	0	4	7	2	4	32	6	15	3	28	3	83	14	0	0	5
April ..	9	6	7	11	9	7	2	38	11	78	11	0	0	5	6	2	3	26	19	12	2	27	3	77	19	1	0	6
May ..	13	4	4	5	3	8	9	43	11	78	11	0	0	5	6	4	4	11	18	9	8	37	3	81	16	0	0	6
June ..	11	1	1	4	1	3	4	72	3	78	19	0	0	6	4	0	2	6	6	7	2	71	2	66	31	1	0	8
July ..	3	0	3	7	1	3	9	69	5	87	8	0	0	5	2	1	0	23	8	9	4	50	3	83	14	0	0	6
August ..	5	1	3	10	6	10	4	56	5	91	4	0	0	4	1	0	1	21	15	15	4	39	4	88	8	0	0	5
September..	6	1	1	7	3	3	6	56	17	78	5	0	0	3	0	0	1	22	17	12	5	40	3	92	5	0	0	4
October ..	4	2	2	3	3	3	3	64	16	81	3	0	0	3	2	0	1	14	19	18	9	34	3	94	3	0	0	3
November	13	6	4	9	5	2	2	47	12	79	9	0	0	4	5	1	11	15	7	11	3	31	16	74	10	0	0	4
December	15	3	6	8	2	1	2	55	8	80	12	0	0	5	4	6	9	13	2	5	1	50	10	77	13	0	0	5
Year ..	9	3	4	9	3	4	5	53	10	81	9	0	0	4	4	2	4	18	11	11	4	41	5	81	14	0	0	5

Authority.—Bibliography No. 22.

* The control vessel *Alert* is stationed about 10 miles south-east of Fao.

Table III—Wind direction, force and speed at Fao 3 113

TABLE IV—MONTHLY FREQUENCY OF WINDS OF DIFFERENT FORCES AT COASTAL STATIONS

Number of occasions per 100 on which particular wind forces may be expected
 C = Calm. I = Beaufort force 1-3. II = force 4-7. III = force 8-12

Time of obs.	Basra (Shahrab)			Bushire	Bahrain	Sharjah	Henjam	Jask	Miscat†
	0500 (Z-3)	0900 (Z-3)	0730 (Z-3)	0730 (Z-3)	0730 (Z-3)	0800 (Z-4)	0800 (Z-4)	0800 (Z-4)	0800 (Z-4)
Wind force	C I II III	C I II III	C I II III	C I II III	C I II III	C I II III	C I II III	C I II III	C I II III
January	12 74 14 0	7 67 26 .9	0 86 14 0	29 35 34 2	4 87 9 0	7 70 23 0	6 74 20 0	5 78 16 0	4 44 2 0
February	17 67 16 0	13 52 34 .7	1 88 11 0	25 51 21 3	4 74 21 1	8 81 11 0	5 78 16 0	5 78 16 0	4 41 7 0
March	21 68 11 0	11 59 30 .3	1 90 9 0	35 41 22 2	2 18 71 11 0	15 70 15 0	7 83 10 0	5 78 16 0	5 78 16 0
April	23 68 9 0	8 56 36 0	7 87 12 0	24 54 21 0	7 14 79 7 0	14 75 11 0	8 80 12 0	6 0 41 57 5 0	4 45 50 5 0
May	27 67 6 0	10 55 35 0	4 84 11 0	6 21 55 23 .6	12 75 13 0	25 65 10 0	12 82 6 0	4 41 57 2 0	4 45 50 5 0
June	16 70 14 0	4 36 60 0	3 72 25 0	16 43 39 2	13 70 17 0	22 77 1 0	7 76 17 0	0 44 55 1 0	0 44 55 1 0
July	9 72 19 0	3 32 65 0	13 76 11 0	30 51 19 0	19 68 13 0	23 62 15 0	2 68 30 0	0 41 58 .7 0	0 41 58 .7 0
August	6 84 10 0	4 51 45 0	9 86 5 0	41 43 15 0	6 10 76 14 0	10 74 16 0	2 73 25 0	0 39 60 1 0	0 39 60 1 0
September	10 84 6 0	4 65 31 0	13 83 3 0	48 40 11 0	7 15 76 9 0	23 70 7 0	13 74 13 0	0 55 45 0 0	0 55 45 0 0
October	9 85 6 0	7 66 27 0	6 91 3 0	47 42 10 0	8 87 5 0	17 78 5 0	21 72 7 0	0 64 34 2 0	0 64 34 2 0
November	21 73 6 0	8 71 21 0	1 94 5 0	44 43 13 0	3 94 3 0	8 83 9 0	12 83 5 0	0 64 34 2 0	0 64 34 2 0
December	14 74 12 0	8 66 26 0	7 92 7 0	19 53 28 0	7 86 6 0	6 84 10 0	3 89 8 0	0 63 36 6 0	0 63 36 6 0
Time of obs.	1600 (Z-3)	1530 (Z-3)*	1530 (Z-3)*	1600 (Z-4)*	1600 (Z-4)*	1600 (Z-4)*	1600 (Z-4)*	1600 (Z-4)*	1600 (Z-4)*

Afternoon

Time of obs.	1600 (Z-3)	1530 (Z-3)*	1530 (Z-3)*	1600 (Z-4)*	1600 (Z-4)*	1600 (Z-4)*	1600 (Z-4)*	1600 (Z-4)*	1600 (Z-4)*
January	5 52 43 .3	0 56 43 1	11 40 49 0	0 63 37 0	11 75 14 0	4 75 21 0	11 69 20 0	0 11 69 20 0	0 11 69 20 0
February	7 46 47 0	0 53 45 2	7 47 42 4	0 63 36 1	7 76 17 0	7 68 31 0	0 12 69 19 0	0 12 69 19 0	0 12 69 19 0
March	7 43 49 .6	0 58 42 1	6 53 38 3	0 47 52 1	6 67 17 0	0 70 30 0	5 82 13 0	5 82 13 0	5 82 13 0
April	4 36 60 0	0 48 51 .7	5 46 48 0	0 42 58 0	3 67 29 1	2 83 15 0	0 14 77 9 0	0 14 77 9 0	0 14 77 9 0
May	2 40 58 0	0 44 56 0	7 48 45 0	0 50 50 0	3 68 29 0	2 77 21 0	0 10 85 5 0	0 10 85 5 0	0 10 85 5 0
June	1 24 75 0	0 46 54 0	5 35 57 3	7 48 51 0	7 78 15 0	0 78 22 0	0 7 90 3 0	0 7 90 3 0	0 7 90 3 0
July	6 22 77 0	0 51 48 .6	3 43 53 .6	0 56 44 0	6 74 20 0	0 81 19 0	0 10 87 3 0	0 10 87 3 0	0 10 87 3 0
August	1 41 58 0	0 39 61 0	3 51 45 .6	0 34 66 0	7 84 9 0	0 77 23 0	0 16 83 1 0	0 16 83 1 0	0 16 83 1 0
September	4 46 50 0	0 39 61 0	9 62 29 0	0 48 52 0	2 95 3 0	1 82 17 0	0 15 85 0 0	0 15 85 0 0	0 15 85 0 0
October	4 54 42 0	0 52 48 0	8 64 28 0	0 50 50 0	8 86 6 0	1 83 16 0	0 19 78 3 0	0 19 78 3 0	0 19 78 3 0
November	6 61 33 0	7 66 32 1	12 42 46 0	7 61 38 0	8 88 4 0	1 81 18 0	0 14 77 9 0	0 14 77 9 0	0 14 77 9 0
December	4 59 37 0	7 61 38 0	13 47 39 .6	0 74 26 0	3 91 6 0	1 74 25 0	0 19 73 8 0	0 19 73 8 0	0 19 73 8 0

Authorities—Bibliography Nos. 42 (Basra), 39 (other stations).
 Periods—Basra, Mar. 1928-Feb. 1933; Henjam, 1933-5; other stations, 1933-7.
 Note.—Similar data for Fao are given in Table III.

* Observations 2 hours later before July, 1934.
 † From Jan. 1933 to July 1935, the observations were made at Bahul Fala.

Persian Gulf and Gulf of Oman

TABLE V—MONTHLY FREQUENCY OF WIND DIRECTION AND SPEED IN THE UPPER AIR AND OF CLOUD MOTION

Number of occasions per 100 on which particular winds may be expected
 I = 3-13 knots (4-15 m.p.h.) II = 14-27 knots (16-31 m.p.h.) III = 28-40 knots (32-47 m.p.h.) IV = over 40 knots (over 47 m.p.h.) C = less than 3 knots (less than 4 m.p.h.)

Basra (Shaibah) 30° 26' N., 47° 41' E., 40 ft.

Time of obs.: 0430-0800 (Z-3).

Period: 1922-32

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
JANUARY																																		
Surface	2	0	0	0	2	0	0	0	6	2	0	0	7	-6	0	0	2	-6	0	0	2	-6	0	0	17	-6	0	0	22	-6	0	0	35	174
1,500	8	4	-7	0	3	0	0	0	3	1	0	0	5	6	4	1	2	4	2	0	1	1	0	0	5	1	1	0	15	25	4	0	3	287
3,000	7	6	-4	0	-7	-7	0	0	1	1	0	0	4	2	-7	-4	4	6	4	0	2	2	-7	0	6	-7	-4	0	20	24	3	0	5	277
6,000	4	2	0	0	1	-9	0	0	-4	0	0	0	-4	0	0	0	6	2	2	0	9	10	1	0	14	8	0	0	16	19	2	-4	3	224
10,000	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	4	7	0	0	4	33	8	1	3	27	9	0	0	105
FEBRUARY																																		
Surface	-6	0	0	0	2	0	0	0	10	0	0	0	8	1	-6	0	4	1	0	0	3	0	0	0	18	3	0	0	9	0	0	0	39	158
1,500	14	4	-4	0	3	-4	0	0	5	-8	0	0	7	5	4	-8	4	3	2	2	5	1	0	0	3	2	-8	0	9	14	3	0	6	264
3,000	10	4	0	0	2	0	0	0	-8	-4	0	0	5	2	2	0	3	3	2	1	2	3	-4	0	7	4	1	0	18	19	3	0	6	256
6,000	4	2	1	0	-5	-5	0	0	2	0	0	0	1	1	0	0	3	1	1	-5	10	6	1	0	6	11	3	0	20	21	1	0	3	208
10,000	4	0	0	-8	0	0	0	0	0	0	0	0	0	0	-8	0	-8	2	0	0	4	9	3	0	11	22	10	2	9	13	6	-8	2	118
MARCH																																		
Surface	5	0	0	0	3	0	0	0	1	-6	0	0	5	2	0	0	8	1	0	0	4	0	0	0	15	2	0	0	15	2	0	0	36	181
1,500	10	10	-3	0	4	2	0	0	5	2	0	0	5	5	1	-3	2	5	2	2	1	1	-3	-3	3	2	0	0	9	21	6	0	2	292
3,000	6	6	0	0	3	0	0	0	5	1	0	0	5	3	-7	0	5	5	2	2	2	2	0	-7	3	2	-7	0	13	23	5	0	3	289
6,000	3	3	-4	0	-8	-4	0	0	1	0	0	0	1	2	-4	0	5	5	-4	0	9	7	-4	-4	10	11	-4	0	12	22	2	0	4	245
10,000	5	3	-7	0	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	8	5	4	0	10	20	11	0	7	18	3	0	0	135
APRIL																																		
Surface	4	-6	0	0	2	-6	0	0	5	2	0	0	6	-6	0	0	6	-6	0	0	5	1	0	0	16	0	0	0	7	-6	0	0	44	176
1,500	5	7	1	-3	5	1	0	0	5	2	0	-3	4	4	2	-3	4	4	2	-3	3	2	1	-7	4	2	0	0	9	17	7	-7	2	295
3,000	7	5	2	0	5	1	0	0	4	1	0	0	3	4	1	0	4	4	1	-3	3	1	2	-3	5	2	0	0	8	24	6	-3	4	288
6,000	6	4	2	0	3	-4	0	0	-4	-4	0	0	1	2	0	0	5	5	2	0	6	3	-4	0	9	11	-4	0	9	21	6	0	3	231
10,000	3	8	0	0	-9	0	0	0	3	0	0	0	2	0	0	0	2	6	0	0	5	7	-9	0	4	20	4	0	6	21	8	0	0	107

Note.—No information of the direction of motion of clouds is available at Basra.

Table V—Wind direction and speed in the upper air 3 115

TABLE V—continued.

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)

II = 14-27 knots
(16-31 m.p.h.)

III = 28-40 knots
(32-47 m.p.h.)

IV = over 40 knots
(over 47 m.p.h.)

C = less than 3 knots
(less than 4 m.p.h.)

Basra (Shaibah)—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
SEPTEMBER																																		
Surface	6	0	0	0	0	0	0	0	1	0	0	0	4	0	0	0	6	0	0	0	7	0	0	0	32	0	0	0	13	6	0	0	37	167
1,500	9	11	4	3	3	1	0	0	2	0	0	0	6	7	0	0	8	1	0	0	1	7	0	0	5	2	0	0	10	20	11	1	3	307
3,000	11	10	3	3	5	3	0	0	5	0	0	0	6	1	0	0	3	0	0	0	1	7	0	0	3	7	0	0	11	24	9	7	2	299
6,000	10	6	3	0	8	1	0	0	2	8	0	0	5	2	0	0	2	0	0	0	4	0	0	0	7	5	0	0	12	24	5	4	5	246
10,000	16	3	0	0	6	8	0	0	5	8	0	0	5	2	0	0	3	3	0	0	4	2	0	0	5	10	2	0	16	13	8	0	2	127
OCTOBER																																		
Surface	5	0	0	0	1	0	0	0	2	6	0	0	1	6	0	0	3	0	0	0	7	0	0	0	34	6	0	0	13	1	0	0	29	173
1,500	12	10	2	0	7	6	0	0	3	0	3	0	4	9	3	0	7	5	9	0	3	3	3	0	3	6	3	0	8	21	5	0	7	316
3,000	11	5	0	0	6	2	0	0	3	6	0	0	5	1	0	0	6	4	6	0	3	2	3	0	5	3	0	0	11	22	5	1	5	311
6,000	13	5	8	0	3	0	0	0	1	4	0	0	4	8	0	0	5	4	0	0	6	5	4	0	8	5	4	0	14	16	2	4	6	266
10,000	5	7	0	0	5	8	0	0	8	8	0	0	1	1	0	0	5	0	0	0	7	5	0	0	13	12	3	0	14	13	2	0	2	133
NOVEMBER																																		
Surface	4	6	0	0	3	6	0	0	4	0	0	0	7	1	0	0	3	0	0	0	3	6	0	0	20	0	0	0	17	6	0	0	35	178
1,500	11	3	0	0	4	3	7	0	5	7	0	0	5	5	1	0	8	6	2	3	2	3	0	0	3	1	0	0	16	18	4	0	6	307
3,000	4	2	3	0	3	0	0	0	3	3	0	0	7	2	3	0	11	7	1	0	6	2	3	0	5	7	0	0	19	18	2	0	7	302
6,000	3	4	0	0	2	0	0	0	4	0	0	0	5	1	4	0	7	4	1	4	10	6	0	0	11	5	4	0	15	14	2	0	5	257
10,000	5	4	0	0	1	7	0	0	1	0	0	0	2	0	0	0	7	3	7	0	5	7	1	0	13	12	3	0	15	12	3	7	4	135
DECEMBER																																		
Surface	1	0	0	0	2	0	0	0	4	0	0	0	7	0	0	0	0	0	0	0	8	2	0	0	18	0	0	0	16	6	0	0	41	169
1,500	6	4	3	0	3	0	0	0	3	1	0	0	6	5	0	3	4	4	2	0	3	0	7	0	2	1	0	0	18	28	3	0	6	295
3,000	5	3	0	0	1	0	0	0	1	4	0	0	4	2	0	0	7	6	1	4	5	2	4	0	3	3	0	0	21	25	2	5	7	284
6,000	7	2	0	0	0	0	0	0	3	0	0	0	2	0	0	0	7	4	4	0	8	8	0	0	8	8	9	0	16	23	2	0	4	233
10,000	4	3	0	0	2	0	0	0	3	0	0	0	0	0	0	0	3	6	0	0	6	11	2	0	7	26	3	8	7	14	2	0	3	120

Authority.—Bibliography No. 42.

Table V—Wind direction and speed in the upper air 3 117

TABLE V--continued.

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots (4-15 m.p.h.) II = 14-27 knots (16-31 m.p.h.) III = 28-40 knots (32-47 m.p.h.) IV = over 40 knots (over 47 m.p.h.) C = less than 3 knots (less than 4 m.p.h.)

Bahrein. 26° 00' N., 50° 35' E. 46 ft. Time of obs. : before 0800 (Z-3½). Period* : Nov. 1927-Dec. 1937

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
JANUARY																																		
Surface ..	4	1	.4	0	.8	0	0	0	1	0	0	0	9	0	0	0	4	0	0	0	2	0	0	0	13	.8	0	0	31	7	.4	0	23	247
1,700 ..	13	25	2	0	5	0	0	0	3	.8	0	0	5	4	.4	0	6	5	2	0	2	3	.4	0	4	.8	0	0	3	13	4	0	3	259
3,300 ..	7	17	2	0	3	0	0	0	3	0	0	0	2	2	0	0	8	7	2	0	7	4	1	0	4	1	1	0	11	13	4	.4	5	256
6,500 ..	7	3	.5	0	0	.5	0	0	.9	0	0	0	.9	0	0	0	2	3	.5	0	8	10	2	0	8	13	4	0	14	15	6	1	.5	219
10,000 ..	1	.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.6	.6	0	0	4	11	5	0	6	17	15	2	5	21	11	1	0	160
Low cloud ..					3				2				1				1				20				38				17				0	167
Medium cloud ..	18				0				0				1				1				15				66				13				1	80
High cloud ..	0				0				0				0				0				23				68				8				0	78
FEBRUARY																																		
Surface ..	8	3	1	.4	1	0	0	0	4	.4	0	0	14	.8	0	0	5	0	0	0	2	0	0	0	7	0	0	0	23	5	.8	0	24	243
1,700 ..	10	21	5	0	4	0	0	0	2	.4	0	0	2	6	2	.4	5	9	3	.9	2	3	.4	.4	3	1	0	0	6	10	3	0	.9	228
3,300 ..	8	13	6	0	2	0	0	0	.9	0	0	0	3	.9	0	0	7	9	4	0	4	7	3	0	4	1	0	.4	8	13	4	.4	.9	223
6,500 ..	2	2	.5	0	.5	0	0	0	2	0	0	0	1	0	0	0	3	3	1	0	7	11	3	0	12	16	4	.5	7	16	8	1	.5	190
10,000 ..	1	1	0	0	.7	0	0	0	0	0	0	0	0	0	0	0	.7	.7	0	0	5	10	3	.7	5	25	17	3	6	9	9	.7	.7	148
Low cloud ..	14				4				0				3				2				20				42				15				0	118
Medium cloud ..	0				0				0				0				2				40				56				2				0	62
High cloud ..	0				0				0				0				0				27				66				7				0	53
MARCH																																		
Surface ..	10	4	.4	.4	2	0	0	0	4	.4	0	0	12	2	.8	0	2	0	0	0	3	0	0	0	9	.8	0	0	17	3	.4	.4	28	259
1,700 ..	10	20	6	.4	4	.4	0	0	2	.7	.4	0	5	4	2	.4	6	4	4	.7	4	2	.4	0	2	1	0	0	9	6	2	0	2	269
3,300 ..	12	14	5	.4	3	0	0	0	4	.4	0	0	5	2	.4	0	6	5	3	.4	5	4	2	.4	3	3	0	0	10	7	2	0	3	259
6,500 ..	7	3	1	0	.9	0	0	0	.4	0	0	0	1	0	0	0	4	2	.9	0	9	15	2	.4	12	7	.4	0	11	13	6	0	.9	230
10,000 ..	5	3	.5	0	0	0	0	0	0	.5	0	0	0	0	0	0	2	1	.5	0	6	15	3	.5	9	22	9	0	9	10	3	.5	.5	185
Low cloud ..	10				0				4				0				2				25				53				5				0	105
Medium cloud ..	0				0				0				0				0				25				64				12				0	76
High cloud ..	4				0				0				0				0				28				61				6				0	64

Note.—The approximate height of the clouds is as follows : Low cloud, 6,500 ft. ; Medium cloud, 16,000 ft. ; High cloud, 33,000 ft. No information of the rate of motion of clouds is available. * Period for cloud motion : Nov. 1927-Dec. 1935.

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Persian Gulf and Gulf of Oman

TABLE V—continued

I = 3-13 knots (4-15 m.p.h.)
 II = 14-27 knots (16-31 m.p.h.)
 III = 28-40 knots (32-47 m.p.h.)
 IV = over 40 knots (over 47 m.p.h.)
 C = less than 3 knots (less than 4 m.p.h.)

Bahrain—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.										
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV																
APRIL																																												
Surface ..	4	5	4	0	5	1	0	0	3	4	0	0	7	4	0	0	5	0	0	0	5	0	0	0	6	4	2	0	4	3	4	0	3	0	0	0	7	4	3	0	33	243		
1,700 ..	15	20	6	8	4	3	0	0	2	2	0	0	3	5	4	0	6	4	2	0	4	3	4	0	3	0	0	0	7	4	3	0	1	241										
3,300 ..	11	15	2	0	3	9	0	0	4	0	0	0	3	9	0	0	6	5	9	0	8	3	4	0	7	3	0	0	7	9	5	9	2	233										
6,500 ..	5	6	5	0	2	5	0	0	3	0	0	0	2	0	0	0	5	1	0	0	8	13	3	0	8	11	9	0	10	13	7	5	9	215										
10,000 ..	3	5	5	0	2	1	0	0	2	2	0	0	2	2	5	0	2	1	0	0	10	8	3	0	6	17	11	0	5	13	3	5	5	183										
Low cloud ..	0				0				0				2				3				43				48				4				0	91										
Medium cloud ..	0				0				0				0				3				40				53				3				0	94										
High cloud ..	0				0				0				0				2				40				46				13				0	70										
MAY																																												
Surface ..	8	5	8	0	2	4	0	0	2	0	0	0	2	0	0	0	2	0	0	0	9	0	0	0	14	4	0	0	24	3	0	0	28	260										
1,700 ..	11	23	14	3	4	2	0	0	3	4	0	0	3	8	0	0	5	3	0	0	2	2	0	0	6	2	4	0	5	9	4	0	1	255										
3,300 ..	9	23	9	8	4	1	0	0	2	0	0	0	2	4	0	0	4	8	4	0	5	2	0	0	9	3	0	0	9	11	4	4	0	246										
6,500 ..	3	11	3	4	2	4	0	0	9	0	0	0	2	0	0	0	5	4	0	0	2	3	1	0	11	10	4	0	9	22	10	4	1	227										
10,000 ..	7	5	2	0	1	6	0	0	1	1	0	0	1	2	0	0	2	0	6	0	5	6	2	0	9	18	5	0	6	19	7	6	0	180										
Low cloud ..	0				0				0				3				7				66				23				2				0	30										
Medium cloud ..	0				0				0				3				3				47				44				3				0	59										
High cloud ..	0				0				0				0				3				47				48				2				0	58										
JUNE																																												
Surface ..	5	3	4	0	8	0	0	0	4	0	0	0	4	0	0	0	4	0	0	0	6	0	0	0	16	0	0	0	31	13	2	4	21	238										
1,700 ..	5	14	28	14	2	4	0	0	4	0	0	0	3	4	0	0	9	0	0	0	2	4	0	0	3	4	4	0	6	9	6	5	9	225										
3,300 ..	4	27	24	6	2	2	0	0	2	0	0	0	1	5	0	0	5	0	0	0	2	0	0	0	3	1	5	0	8	8	5	5	5	196										
6,500 ..	5	22	6	1	4	0	0	0	0	1	0	0	1	1	0	0	1	1	0	0	2	6	0	0	3	0	0	0	5	6	6	0	10	21	10	3	2	157						
10,000 ..	9	14	4	0	4	3	0	0	1	1	1	0	8	4	1	0	5	4	0	0	3	2	0	0	4	6	0	1	6	15	6	0	1	105										
Low cloud ..																																												
Medium cloud ..																																												
High cloud ..																																												

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft. No information of the rate of motion of clouds is available.

Table V—Wind direction and speed in the upper air 3 119

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)II = 14-27 knots
(16-31 m.p.h.)III = 28-40 knots
(32-47 m.p.h.)IV = over 40 knots
(over 47 m.p.h.)C = less than 3 knots
(less than 4 m.p.h.)

Bahrein—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
JULY																																		
Surface ..	7	1	0	0	1	0	0	0	2	0	0	0	1	0	0	0	4	0	0	0	5	0	0	0	20	7	0	0	26	6	4	0	29	271
1,700 ..	7	17	24	7	1	8	0	0	2	0	0	0	2	0	0	0	2	0	0	0	2	4	0	0	3	4	0	0	11	14	4	2	8	250
3,300 ..	8	30	21	3	2	2	0	0	0	5	0	0	5	0	0	0	1	5	0	0	9	0	0	0	1	5	0	0	5	14	6	1	2	212
6,500 ..	9	24	5	6	8	3	6	0	1	1	0	0	0	0	0	0	1	6	0	0	3	0	0	0	1	0	0	0	6	22	10	1	2	156
10,000 ..	8	10	0	9	7	9	0	0	9	4	9	0	3	4	0	0	9	0	0	0	4	0	0	0	3	3	0	0	9	19	4	2	2	112
Low cloud ..									Data not available.																									
Medium cloud ..	6				19				27				25				1				0				11				8				4	42
High cloud ..	0				0				37				63				0				0				0				0				0	4
AUGUST																																		
Surface ..	2	4	0	0	2	0	0	0	1	0	0	0	2	0	0	0	1	0	0	0	4	0	0	0	12	0	0	0	17	6	0	0	51	281
1,700 ..	13	11	10	4	6	2	0	0	7	0	0	0	3	2	0	0	3	2	0	0	3	4	0	0	7	4	0	0	14	9	2	4	2	267
3,300 ..	18	25	5	2	9	2	0	0	5	4	0	0	2	0	0	0	2	4	0	0	4	4	0	0	4	0	0	0	9	7	2	4	2	238
6,500 ..	15	19	5	0	16	2	0	0	4	1	0	0	2	0	0	0	3	5	0	0	3	0	0	0	2	0	0	0	10	11	3	0	4	208
10,000 ..	14	2	2	6	12	3	0	0	11	5	0	0	8	6	6	0	4	1	0	0	3	6	0	0	4	1	0	0	11	8	2	6	5	171
Low cloud ..	0				0				0				25				0				0				25				50				0	3
Medium cloud ..	11				29				6				8				3				31				9				6				0	40
High cloud ..	0				8				27				25				21				13				6				0				0	9
SEPTEMBER																																		
Surface ..	1	2	0	0	1	0	0	0	2	0	0	0	3	0	0	0	4	0	0	0	6	0	0	0	12	0	0	0	20	4	4	0	44	275
1,700 ..	16	17	6	0	7	1	0	0	4	7	0	0	5	0	0	0	4	0	0	0	4	0	0	0	6	0	0	0	15	6	2	0	4	270
3,300 ..	19	24	6	0	12	4	0	0	5	8	0	0	2	0	0	0	2	4	0	0	3	0	0	0	4	0	0	0	10	4	3	0	4	259
6,500 ..	19	16	3	0	15	7	0	0	4	2	0	0	2	0	4	0	3	0	0	0	1	8	0	0	4	4	0	0	6	9	4	0	2	241
10,000 ..	14	12	4	0	12	5	0	0	11	2	0	0	10	5	5	0	4	5	0	0	2	0	0	0	3	0	2	0	5	6	3	0	4	196
Low cloud ..	0				13				13				25				0				0				13				37				0	6
Medium cloud ..	14				14				61				10				0				0				0				0				0	13
High cloud ..									Data not available.																								0	13

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft.
No information of the rate of motion of clouds is available.

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)

II = 14-27 knots
(16-31 m.p.h.)

III = 28-40 knots
(32-47 m.p.h.)

IV = over 40 knots
(over 47 m.p.h.)

C = less than 3 knots
(less than 4 m.p.h.)

Bahrain—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
OCTOBER																																		
Surface ..	5	.4	.4	0	.8	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	2	0	0	0	16	.4	0	0	22	2	0	0	49	259
1,700 ..	23	21	4	0	7	2	0	0	2	0	0	0	4	0	0	0	4	1	0	0	5	0	0	0	3	0	0	0	15	6	0	0	3	252
3,300 ..	17	25	6	.4	11	3	.4	0	2	0	0	0	3	0	0	0	2	.4	0	0	4	2	0	0	6	0	0	0	9	5	2	0	2	253
6,500 ..	8	24	4	0	10	7	.4	0	5	1	0	0	3	2	0	0	2	.9	0	0	3	0	0	0	4	1	0	0	8	9	3	1	2	230
10,000 ..	5	18	6	.5	10	5	0	0	9	2	0	0	7	3	0	0	2	0	0	0	1	0	.5	0	5	2	.5	0	7	10	4	1	2	183
Low cloud ..	31				33				2				.0				0				6				10				18				0	15
Medium cloud ..	0				0				0				.6				27				11				33				7				16	20
High cloud ..	0				0				0				0				4				33				59				4				0	40
NOVEMBER																																		
Surface ..	5	1	.3	0	2	0	0	0	1	0	0	0	6	0	0	0	6	0	0	0	3	0	0	0	12	0	0	0	27	2	0	0	35	289
1,700 ..	16	19	.7	0	6	0	0	0	5	0	0	0	6	2	.4	0	6	6	2	0	5	.7	0	0	5	.4	0	0	9	8	.4	0	2	283
3,300 ..	20	19	.7	0	7	.4	0	0	3	0	0	0	3	.4	0	0	8	5	.7	0	8	2	.4	0	6	.4	0	0	8	6	.4	0	3	281
6,500 ..	9	7	.4	0	4	.8	0	0	5	2	0	0	6	2	0	0	4	4	0	0	9	6	0	0	9	2	.4	0	14	13	.8	0	3	252
10,000 ..	7	6	.5	0	5	0	0	0	5	.9	.5	0	2	.5	.5	0	6	3	0	0	7	5	0	0	12	11	2	0	12	12	.9	0	1	214
Low cloud ..	19				2				0				0				6				24				25				23				0	73
Medium cloud ..	0				0				0				0				2				36				61				0				0	48
High cloud ..	0				0				0				0				0				27				61				12				0	124
DECEMBER																																		
Surface ..	4	1	.4	0	.4	0	0	0	0	0	0	0	4	0	0	0	5	.4	0	0	2	.4	0	0	15	.7	0	0	31	8	0	0	27	273
1,700 ..	14	27	2	0	1	.4	0	0	.4	0	0	0	4	2	0	0	6	4	1	.4	5	2	1	0	4	1	0	0	7	12	4	0	1	279
3,300 ..	11	19	1	0	3	.4	0	0	.7	0	0	0	3	1	0	0	7	3	1	0	9	4	1	0	5	2	0	0	14	11	2	0	1	273
6,500 ..	5	6	1	0	3	.4	0	0	2	0	0	0	2	0	0	0	5	2	0	0	6	8	.9	0	12	15	2	0	13	14	2	0	.9	233
10,000 ..	6	5	0	0	.6	0	0	0	2	0	0	0	0	0	0	0	3	0	0	0	4	8	3	0	10	23	7	2	6	15	4	0	2	181
Low cloud ..	23				3				1				2				3				17				29				22				0	140
Medium cloud ..	0				0				0				1				0				18				63				17				1	101
High cloud ..	0				0				0				0				0				27				63				10				0	79

Table V—Wind direction and speed in the upper air 3 121

Authorities.—Bibliography Nos. 27, 39.

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft. No information of the rate of motion of clouds is available.

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)II = 14-27 knots
(16-31 m.p.h.)III = 28-40 knots
(32-47 m.p.h.)IV = over 40 knots
(over 47 m.p.h.)C = less than 3 knots
(less than 4 m.p.h.)

Jask., 25° 45' N., 57° 45' E., <33 ft.

Time of obs. : not known.

Period : June, 1924-June, 1925

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
JANUARY																																		
Surface ..	26	0	0	0	13	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	23	30
1,700 ..	3	0	0	0	7	0	0	0	3	0	0	0	13	3	0	0	3	0	0	0	7	0	0	0	23	3	0	0	17	17	0	0	0	30
3,300 ..	0	0	0	0	0	0	0	0	7	0	0	0	3	0	0	0	0	0	0	0	20	0	0	0	26	0	0	0	23	20	0	0	0	30
6,500 ..	0	0	0	0	0	0	0	0	7	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	11	37	15	0	7	7	7	0	0	27
10,000 ..	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	0	0	20	28	24	8	4	0	8	0	25
FEBRUARY																																		
Surface ..	14	0	0	0	40	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	0	0	7	0	0	0	25	28
1,700 ..	14	4	0	0	11	4	0	0	18	0	0	0	4	4	0	0	4	0	0	0	7	0	0	0	7	7	0	0	11	4	0	0	4	28
3,300 ..	12	0	0	0	8	0	0	0	12	0	0	0	19	0	0	0	4	0	0	0	4	0	0	0	4	15	0	0	19	0	0	0	4	26
6,500 ..	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4	4	0	0	12	8	0	0	12	8	12	0	15	8	4	0	8	26
10,000 ..	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	13	47	25	4	4	13	13	0	0	24
MARCH																																		
Surface*	0	0	0	0	6	0	0	0	8*	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	12	0	0	0	18	0	0	0	41	17
1,700 ..	18	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	6	0	0	0	18	0	0	0	35	18	0	0	0	17
3,300 ..	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	12	0	0	0	18	0	0	0	18	23	0	0	6	17
6,500 ..	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	12	6	0	0	29	0	0	18	18	0	0	0	17
10,000 ..	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	13	0	0	37	13	0	19	19	0	0	0	16
APRIL																																		
Surface ..	5	0	0	0	5	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	18	0	0	0	27	22
1,700 ..	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	14	0	0	0	50	23	0	0	0	22
3,300 ..	5	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	9	0	0	45	18	0	0	0	22
6,500 ..	0	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	18	0	0	5	27	0	5	0	22
10,000 ..	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	15	0	0	20	25	10	0	10	0	0	0	10	0	0	0	10	20

Note.—The number of observations is not sufficient to give a reliable normal.
Observations of cloud motion are not available.

* The total of these figures is only 91, it is probable that the frequency of E. winds should be 18 per cent. and not 8.

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)

II = 14-27 knots
(16-31 m.p.h.)

III = 28-40 knots
(32-47 m.p.h.)

IV = over 40 knots
(over 47 m.p.h.)

C = less than 3 knots
(less than 4 m.p.h.)

Jask—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV						
MAY																																						
Surface ..	7	0	0	0	0	0	0	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	3	0	0	3	0	0	0	23	31
1,700 ..	7	3	0	0	3	0	0	0	10	0	0	0	19	0	0	0	0	0	0	0	3	0	0	0	7	0	0	0	7	0	0	0	26	13	3	0	7	31
3,300 ..	0	3	0	0	0	3	0	0	7	3	0	0	13	0	0	0	3	0	0	0	7	0	0	0	10	3	0	0	23	19	0	0	7	31				
6,500 ..	10	3	0	0	13	0	0	0	3	3	0	0	0	0	0	0	3	0	0	0	3	3	3	0	23	7	0	0	10	10	0	0	7	31				
10,000 ..	16	0	0	0	10	3	0	0	7	3	0	0	16	0	0	0	0	0	0	0	3	7	0	0	16	10	0	0	10	0	0	0	0	31				
JUNE																																						
Surface ..	6	0	0	0	3	0	0	0	14	3	0	0	6	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	17	0	0	0	39	36				
1,700 ..	19	0	0	0	6	0	0	0	8	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	14	8	0	0	14	22	0	0	3	36				
3,300 ..	14	3	0	0	6	0	0	0	11	0	3	0	3	0	0	0	3	0	0	0	3	0	0	0	14	19	0	0	14	8	0	0	0	36				
6,500 ..	6	0	0	0	6	0	0	0	8	3	0	0	11	0	0	0	3	0	0	0	6	0	0	0	20	6	0	0	17	14	0	0	0	35				
10,000 ..	0	0	0	0	8	0	0	0	8	0	0	0	3	0	3	0	18	0	0	0	8	0	0	0	28	3	0	0	15	0	0	0	8	35				
JULY																																						
Surface ..	3	0	0	0	0	0	0	0	35	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	16	0	0	0	35	31				
1,700 ..	10	0	0	0	10	3	0	0	13	10	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	32	16	0	0	6	31				
3,300 ..	3	0	0	0	13	3	0	0	6	10	0	0	3	0	0	0	0	0	0	0	6	0	0	0	10	6	0	0	29	6	0	0	3	31				
6,500 ..	13	0	0	0	7	3	0	0	13	3	0	0	0	0	0	0	0	0	0	0	3	0	0	0	13	0	0	0	17	7	0	0	13	30				
10,000 ..	0	0	0	0	10	3	0	0	13	0	0	0	10	0	0	0	3	0	0	0	17	0	0	0	17	0	0	0	27	0	0	0	10	30				
AUGUST																																						
Surface ..	0	0	0	0	0	0	0	0	65	7	0	0	3	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	10	0	0	0	10	31				
1,700 ..	10	0	0	0	10	0	0	0	23	13	3	0	7	3	0	0	0	0	0	0	7	0	0	0	10	0	0	0	7	7	0	0	0	30				
3,300 ..	21	0	0	0	4	0	0	0	7	0	0	0	0	4	0	0	4	0	0	0	11	0	0	0	21	4	0	0	14	11	0	0	4	28				
6,500 ..	16	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	12	0	0	0	20	12	0	0	4	4	0	0	12	25				
10,000 ..	0	0	0	0	17	13	0	0	4	9	0	0	22	0	0	0	0	0	0	0	4	0	0	0	13	4	0	0	9	0	0	0	4	23				

Table V—Wind direction and speed in the upper air 3 123

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)II = 14-27 knots
(16-31 m.p.h.)III = 28-40 knots
(32-47 m.p.h.)IV = over 40 knots
(over 47 m.p.h.)C = less than 3 knots
(less than 4 m.p.h.)

Jask—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV					
SEPTEMBER																																					
Surface ..	13	0	0	0	13	0	0	0	27	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	30
1,700 ..	10	0	0	0	27	3	0	0	13	7	0	0	10	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	30	
3,300 ..	4	0	0	0	24	24	4	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	12	0	0	0	20	0	0	0	4	4	25	25		
6,500 ..	8	0	0	0	12	20	0	0	0	4	0	0	8	0	0	0	4	0	0	0	0	0	0	32	0	0	0	4	0	0	0	8	4	25	25		
10,000 ..	13	4	0	0	13	4	0	0	4	0	0	0	25	0	0	0	13	0	0	0	4	0	0	0	4	0	0	0	8	4	0	0	4	24	24		
OCTOBER																																					
Surface ..	3	0	0	0	19	0	0	0	42	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	31		
1,700 ..	20	0	0	0	13	7	0	0	17	0	0	0	10	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	30		
3,300 ..	27	0	0	0	20	7	0	0	3	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	30		
6,500 ..	13	0	0	0	23	3	0	0	7	0	0	0	13	0	0	0	7	0	0	0	13	0	0	0	3	0	0	0	3	0	0	0	13	30	30		
10,000 ..	7	3	0	0	30	3	0	0	13	0	0	0	23	0	0	0	3	7	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	
NOVEMBER																																					
Surface ..	3	0	0	0	27	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	30		
1,700 ..	13	0	0	0	17	0	0	0	7	0	0	0	7	0	0	0	0	0	0	0	0	0	0	7	0	0	0	23	0	0	0	27	30	30			
3,300 ..	7	0	0	0	13	0	0	0	23	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	13	0	0	0	28	3	0	0	10	30	30		
6,500 ..	21	0	0	0	7	0	0	0	21	0	0	0	3	0	0	0	3	0	0	0	3	7	0	0	3	0	0	0	24	3	0	0	3	29	29		
10,000 ..	21	0	0	0	21	0	0	0	7	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	17	0	0	0	28	0	0	0	3	29	29		
DECEMBER																																					
Surface ..	23	0	0	0	27	0	0	0	17	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	30		
1,700 ..	0	3	0	0	10	0	0	0	7	0	0	0	20	13	3	0	3	0	0	0	3	0	0	0	10	0	0	0	20	3	0	0	3	30	30		
3,300 ..	0	0	0	0	7	0	0	0	7	0	0	0	11	11	0	0	4	4	0	0	7	0	0	0	29	0	0	0	14	0	0	0	7	28	28		
6,500 ..	9	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	4	0	0	4	4	0	0	13	4	0	0	13	9	0	0	4	23	23		
10,000 ..	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	27	31	5	0	5	18	0	0	0	22	22		

Authority.—Bibliography No. 23.

TABLE V—continued.

Number of occasions per 100 on which particular winds may be expected
 I = 3-13 knots (4-15 m.p.h.) II = 14-27 knots (16-31 m.p.h.) III = 28-40 knots (32-47 m.p.h.) IV = over 40 knots (over 47 m.p.h.) C = less than 3 knots (less than 4 m.p.h.)
 Gwadar. 25° 07' N., 62° 20' E. 33 ft. Time of obs.: not known. Period*: Sept. 1927—Dec. 1929, Jan. 1937—May 1938

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
JANUARY																																		
Surface ..	8	2	0	0	11	0	0	0	2	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	6	0	0	0	16	8	0	0	49	122
1,700 ..	12	4	0	0	14	2	0	0	8	0	0	0	2	2	0	0	6	8	0	0	12	0	0	0	14	7	0	0	10	8	0	0	7	120
3,300 ..	10	12	0	0	8	9	0	0	6	0	0	0	3	9	0	0	9	2	0	0	8	9	0	0	14	7	0	0	11	4	0	0	3	117
6,500 ..	7	0	0	0	2	9	0	0	9	9	0	0	0	0	0	0	4	0	0	0	3	2	0	0	20	19	3	0	12	24	2	0	9	107
10,000 ..	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	1	1	1	10	38	8	0	6	21	5	0	0	92
Low cloud ..	0				0				5				18				19				29				29				0				0	137
Medium cloud ..	0				0				0				1				0				11				79				8				0	49
High cloud ..	0				0				0				0				0				6				89				5				0	121
FEBRUARY																																		
Surface ..	7	0	0	0	14	9	0	0	5	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	14	9	0	0	15	9	0	0	38	112
1,700 ..	9	4	0	0	4	4	0	0	6	9	0	0	8	3	0	0	6	0	0	0	7	0	0	0	19	10	9	0	10	4	0	0	5	112
3,300 ..	6	7	0	0	6	9	0	0	3	0	0	0	8	3	0	0	5	9	0	0	12	2	0	0	18	6	2	0	15	4	0	0	3	109
6,500 ..	9	3	0	0	1	0	0	0	3	0	0	0	2	0	0	0	3	0	0	0	7	6	1	0	17	15	4	0	8	18	0	0	2	96
10,000 ..	4	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	4	2	0	9	23	9	0	12	17	9	0	0	81
Low cloud ..	1				3				11				11				20				28				23				4				0	102
Medium cloud ..	0				2				0				0				0				19				67				12				0	50
High cloud ..	0				0				0				0				0				4				92				4				0	90
MARCH																																		
Surface ..	2	0	0	0	2	0	0	0	2	0	0	0	4	8	0	0	0	0	0	0	6	8	0	0	32	8	0	0	16	0	0	0	33	122
1,700 ..	6	8	0	0	11	3	0	0	8	0	0	0	8	8	0	0	3	8	0	0	7	8	0	0	19	21	3	0	12	9	0	0	2	120
3,300 ..	5	3	0	0	7	3	0	0	8	0	0	0	3	0	0	0	5	8	0	0	3	3	0	0	16	22	4	0	8	12	2	0	2	118
6,500 ..	3	3	0	0	4	2	0	0	3	0	0	0	6	0	0	0	1	1	0	0	4	5	0	0	12	19	12	1	12	10	2	0	2	104
10,000 ..	7	3	0	0	1	4	0	0	4	0	0	0	0	0	0	0	1	0	0	0	5	5	0	0	5	21	21	1	3	11	8	0	0	76
Low cloud ..	0				0				2				5				17				29				46				1				0	74
Medium cloud ..	0				0				0				0				0				26				62				12				0	29
High cloud ..	0				0				0				0				0				10				79				11				0	107

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft.
 No information of the rate of motion of clouds is available. * Period for cloud motion: Sept. 1927—Dec. 1935.

Table V—Wind direction and speed in the upper air 3 125

TABLE V—continued.

I = 3-13 knots (4-15 m.p.h.) II = 14-27 knots (16-31 m.p.h.) III = 28-40 knots (32-47 m.p.h.) IV = over 40 knots (over 47 m.p.h.) C = less than 3 knots (less than 4 m.p.h.)

Gwadar—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV						
	APRIL																																	
Surface ..	3	0	0	0	3	0	0	0	6	0	0	0	3	0	0	0	.8	0	0	0	14	2	0	0	24	0	0	0	8	0	0	0	35	119
1,700 ..	3	3	0	0	3	.8	0	0	5	0	0	0	3	0	0	0	4	0	0	0	14	0	0	0	27	23	.8	0	8	5	0	0	2	119
3,300 ..	8	3	0	0	5	2	0	0	2	0	0	0	2	0	0	0	.8	0	0	0	8	2	0	0	15	19	3	0	18	11	0	0	3	118
6,500 ..	11	0	0	0	4	1	0	0	6	0	0	0	2	0	0	0	1	0	0	0	1	1	0	0	18	14	5	1	16	16	0	0	1	98
10,000 ..	15	1	0	0	6	1	0	0	4	3	0	0	0	4	0	0	3	0	0	0	6	6	1	0	11	8	3	0	22	6	0	0	0	80
Low cloud ..	0				0				7				8				10				35				39				2	0			0	78
Medium cloud ..	0				0				0				0				0				18				76				6	0			0	37
High cloud ..	0				0				0				0				1				20				67				13	0			0	113
MAY																																		
Surface ..	.8	0	0	0	3	0	0	0	7	0	0	0	3	0	0	0	.8	0	0	0	21	5	0	0	30	0	0	0	0	0	0	0	29	124
1,700 ..	4	.8	0	0	6	2	0	0	3	0	0	0	5	0	0	0	6	0	0	0	9	2	0	0	16	34	3	0	3	5	0	0	.8	124
3,300 ..	4	4	0	0	8	4	0	0	2	0	0	0	2	0	0	0	.9	0	0	0	4	2	0	0	15	28	4	0	12	12	0	0	0	113
6,500 ..	12	2	0	0	4	4	0	0	4	1	0	0	0	0	0	0	0	0	0	0	2	4	0	0	15	15	5	0	21	11	1	0	0	85
10,000 ..	20	3	0	0	9	6	0	0	0	2	0	0	6	0	0	0	5	2	0	0	3	0	0	0	11	8	2	2	14	2	2	0	6	65
Low cloud ..	0				0				0				2				18				43				36				0	0			0	107
Medium cloud ..	.12				8				17				0				4				4				42				0	17			0	11
High cloud ..	0				0				0				0				0				18				70				12	0			0	64
JUNE																																		
Surface ..	0	0	0	0	7	0	0	0	17	0	0	0	6	0	0	0	3	0	0	0	28	0	0	0	6	0	0	0	1	0	0	0	31	89
1,700 ..	1	0	0	0	5	0	0	0	10	0	0	0	13	0	0	0	13	0	0	0	19	1	0	0	25	3	0	0	7	0	0	0	3	88
3,300 ..	4	1	0	0	12	3	0	0	1	0	0	0	1	0	0	0	8	0	0	0	13	0	0	0	20	5	0	0	20	8	0	0	3	75
6,500 ..	24	7	0	0	10	5	0	0	3	0	0	0	0	0	0	0	5	0	0	0	2	0	0	0	7	3	0	0	19	10	2	0	2	58
10,000 ..	15	17	0	0	15	10	0	0	8	0	0	0	0	2	0	0	6	0	0	0	0	0	0	0	4	8	0	0	10	2	0	0	4	48
Low cloud ..	0				1				5				22				20				27				23				1	0			0	203
Medium cloud ..	5				29				43				1				0				3				6				8	3			0	28
High cloud ..	7				11				48				27				0				0				0				7	0			0	11

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft. No information of the rate of motion of clouds is available.

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)

II = 14-27 knots
(16-31 m.p.h.)

III = 28-40 knots
(32-47 m.p.h.)

IV = over 40 knots
(over 47 m.p.h.)

C = less than 3 knots
(less than 4 m.p.h.)

Gwadar—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
JULY																																		
Surface ..	0	0	0	0	3	0	0	0	11	0	0	0	13	0	0	0	6	0	0	0	18	0	0	0	6	0	0	0	0	0	0	0	42	93
1,700 ..	3	0	0	0	1	1	0	0	4	3	0	0	19	0	0	0	16	0	0	0	25	2	0	0	12	2	0	0	4	0	0	0	6	93
3,300 ..	8	0	0	0	5	3	0	0	11	2	0	0	3	0	0	0	7	0	0	0	18	0	0	0	13	3	0	0	12	2	0	0	13	61
6,500 ..	27	4	0	0	18	4	0	0	7	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	18	11	0	0	2	45
10,000 ..	26	14	0	0	6	9	0	0	0	9	0	0	3	0	0	0	0	0	0	0	0	0	0	0	6	3	0	0	20	0	0	0	6	35
Low cloud ..		4				1				11				33				24				24				6				1			0	355
Medium cloud ..		9				32				20				0				10				7				5				11			6	87
High cloud ..		4				15				48				15				4				0				8				4			2	35
AUGUST																																		
Surface ..	1	0	0	0	6	0	0	0	10	0	0	0	12	0	0	0	7	0	0	0	10	0	0	0	7	0	0	0	0	0	0	0	47	86
1,700 ..	0	2	0	0	3	0	0	0	8	0	0	0	27	0	0	0	26	0	0	0	14	2	0	0	8	2	0	0	0	0	0	0	11	66
3,300 ..	5	5	3	0	11	0	0	0	16	0	0	0	13	0	0	0	16	0	0	0	11	0	0	0	8	0	0	0	13	0	0	0	0	38
6,500 ..	33	7	7	0	7	13	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	13	0	0	0	0	15
10,000 ..	17	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	33	0	0	17	12
Low cloud ..		0				2				12				30				28				21				5				1			1	294
Medium cloud ..		4				30				38				2				2				5				5				15			0	35
High cloud ..		2				12				65				12				0				2				3				3			0	39
SEPTEMBER																																		
Surface ..	0	0	0	0	5	0	0	0	7	0	0	0	2	0	0	0	2	0	0	0	17	0	0	0	22	0	0	0	0	0	0	0	45	58
1,700 ..	7	3	0	0	14	2	0	0	9	0	0	0	7	0	0	0	12	0	0	0	18	0	0	0	14	0	0	0	9	2	0	0	3	57
3,300 ..	18	2	0	0	25	9	0	0	18	0	0	0	2	0	0	0	7	0	0	0	0	0	0	0	5	0	0	0	5	0	0	0	9	44
6,500 ..	38	0	0	0	13	5	0	0	13	5	0	0	0	3	0	0	5	0	0	0	0	0	0	0	11	0	0	0	3	0	0	0	3	37
10,000 ..	17	7	0	0	10	31	0	0	0	10	0	0	3	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	17	0	0	0	0	29
Low cloud ..		0				1				3				13				18				35				29				1			0	222
Medium cloud ..		8				8				17				13				46				8				0				0			0	10
High cloud ..		5				5				33				36				17				0				0				0			5	17

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft.
No information of the rate of motion of clouds is available.

Table V—Wind direction and speed in the upper air 8 127

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)II = 14-27 knots
(16-31 m.p.h.)III = 28-40 knots
(32-47 m.p.h.)IV = over 40 knots
(over 47 m.p.h.)C = less than 3 knots
(less than 4 m.p.h.)

Gwadar—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.	
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV			
OCTOBER																																			
Surface ..	1	0	0	0	10	0	0	0	8	0	0	0	2	0	0	0	1	0	0	0	11	0	0	0	24	0	0	0	6	0	0	0	37		90
1,700 ..	8	1	0	0	9	5	0	0	10	1	0	0	8	0	0	0	9	0	0	0	11	0	0	0	20	5	0	0	9	2	0	0	1		88
3,300 ..	13	3	0	0	17	3	0	0	14	1	0	0	1	0	0	0	5	0	0	0	5	0	0	0	11	1	0	0	14	5	0	0	5		76
6,500 ..	12	1	0	0	19	3	0	0	7	0	0	0	7	0	0	0	4	1	0	0	1	0	0	0	4	0	0	0	25	4	0	0	10		69
10,000 ..	18	16	2	0	15	2	0	0	4	4	0	0	2	0	0	0	4	0	0	0	4	0	0	0	5	2	0	0	16	4	0	0	4		55
Low cloud ..	0				2				8				11				15				23				37				4				0	127	
Medium cloud ..	0				0				15				15				3				58				8				0				0	26	
High cloud ..	0				0				10				10				0				36				43				1				0	22	
NOVEMBER																																			
Surface ..	2	0	0	0	8	1	0	0	3	0	0	0	2	0	0	0	0	0	0	0	3	0	0	0	17	0	0	0	12	0	0	0	52		97
1,700 ..	15	0	0	0	26	8	0	0	6	1	0	0	1	0	0	0	1	0	0	0	3	0	0	0	10	2	0	0	17	1	0	0	8		97
3,300 ..	19	6	0	0	20	3	0	0	13	4	0	0	3	0	0	0	3	0	0	0	8	0	0	0	6	0	0	0	6	1	0	0	7		97
6,500 ..	11	2	0	0	19	2	0	0	18	0	0	0	5	1	0	0	5	1	0	0	5	2	0	0	7	1	1	0	11	1	0	0	6		96
10,000 ..	11	1	0	0	10	4	0	0	11	0	0	0	3	3	0	0	6	2	0	0	11	10	0	0	5	2	0	0	12	4	0	0	5		94
Low cloud ..	0				0				4				0				12				46				38				0				0	36	
Medium cloud ..	0				0				0				2				5				43				50				0				0	35	
High cloud ..	0				0				1				0				1				26				57				9				4	116	
DECEMBER																																			
Surface ..	5	0	0	0	17	3	0	0	6	8	0	0	8	2	0	0	0	0	0	0	0	0	0	0	11	0	0	0	16	8	0	0	38		119
1,700 ..	8	3	0	0	17	5	0	0	15	3	0	0	5	2	0	0	2	0	0	0	4	0	0	0	13	3	0	0	11	2	0	0	8		118
3,300 ..	7	7	0	0	9	6	0	0	11	9	0	0	7	4	0	0	7	9	0	0	4	9	0	0	14	2	0	0	9	9	0	0	9		117
6,500 ..	11	5	0	0	3	4	0	0	3	0	0	0	4	0	0	0	12	2	0	0	6	0	0	0	13	13	0	0	16	4	0	0	4		112
10,000 ..	10	5	1	0	0	1	0	0	1	0	0	0	0	1	0	0	1	1	0	0	4	5	0	0	15	12	9	2	15	17	1	0	1		102
Low cloud ..	1				1				20				17				11				22				25				4				0	92	
Medium cloud ..	0				0				0				5				0				34				55				6				0	45	
High cloud ..	1				0				0				0				1				11				68				15				2	142	

Authorities.—Bibliography Nos. 23, 27, 38.

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft.
No information of the rate of motion of clouds is available.

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected
 I = 3-13 knots (4-15 m.p.h.) II = 14-27 knots (16-31 m.p.h.) III = 28-40 knots (32-47 m.p.h.) IV = over 40 knots (over 47 m.p.h.) C = less than 3 knots (less than 4 m.p.h.)

Muscat (Baitul Falaj). 23° 37' N., 58° 36' E., 66 ft. Time of obs. : before 0830 (Z-4). Period* : Sept. 1927-July, 1935.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV						
JANUARY																																						
Surface ..	1	0	0	0	2	0	0	0	-9	0	0	0	2	-4	0	0	7	-4	0	0	1	0	0	0	8	-4	0	0	3	-4	0	0	73	229				
1,700 ..	9	-9	0	0	5	-9	0	0	8	-4	0	0	10	-9	0	0	5	-4	0	0	18	4	-4	0	18	3	0	0	9	233								
3,300 ..	13	-4	0	0	5	-9	0	0	8	-9	0	0	8	-9	0	0	7	-9	0	0	8	-4	0	0	15	3	-9	0	17	5	1	0	3	231				
6,500 ..	6	2	0	0	4	-5	0	0	4	0	0	0	1	0	0	0	5	-5	0	0	9	5	-5	0	16	14	-5	0	18	11	1	0	2	201				
10,000 ..	3	3	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	8	5	1	0	9	28	10	0	6	16	8	0	-5	186				
Low cloud ..	7				2				12				7				4				11				23				31				2	156				
Medium cloud ..	0				0				0				1				7				16				59				16				0	53				
High cloud ..	0				0				0				0				0				9				79				12				0	115				
FEBRUARY																																						
Surface ..	-5	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	10	0	0	0	2	0	0	0	15	0	0	0	5	0	0	0	64	217				
1,700 ..	3	-5	0	0	-9	0	0	0	5	-5	0	0	9	-5	0	0	5	1	0	0	9	2	-5	0	20	10	0	0	19	5	0	0	10	219				
3,300 ..	3	0	0	0	2	-5	0	0	6	0	0	0	8	0	0	0	5	1	-5	0	9	2	-9	0	21	9	-9	0	16	7	1	0	6	215				
6,500 ..	4	2	0	0	3	1	0	0	3	0	0	0	3	1	0	0	5	-5	-5	0	7	5	2	0	13	18	4	-5	16	10	1	0	1	199				
10,000 ..	5	3	0	0	1	-6	-6	0	2	0	0	0	2	0	0	0	5	1	0	0	3	9	1	2	5	23	9	1	6	18	2	-6	-6	175				
Low cloud ..	4				1				9				2				1				10				46				29				0	106				
Medium cloud ..	0				2				0				0				0				25				62				11				0	42				
High cloud ..	0				0				0				0				0				10				79				11				0	62				
MARCH																																						
Surface ..	1	0	0	0	-9	0	0	0	-9	0	0	0	4	0	0	0	5	0	0	0	3	-4	0	0	10	2	0	0	6	-4	0	0	67	233				
1,700 ..	3	0	0	0	1	0	0	0	2	0	0	0	3	1	0	0	8	1	-4	0	14	2	0	0	29	7	0	0	18	5	0	0	5	231				
3,300 ..	6	0	0	0	2	0	0	0	3	0	0	0	5	-4	0	0	8	1	0	0	13	3	0	0	20	9	-9	0	13	8	1	0	7	229				
6,500 ..	7	1	0	0	4	0	0	0	5	0	0	0	3	0	0	0	2	1	-5	0	12	3	-5	0	14	15	2	0	15	10	1	0	2	214				
10,000 ..	5	5	0	0	3	0	0	0	2	1	0	0	1	1	0	0	2	1	0	0	6	3	1	0	12	22	7	-5	10	14	1	0	-5	191				
Low cloud ..	4				2				4				0				3				26				46				15				0	55				
Medium cloud ..	0				0				0				0				2				12				81				5				0	54				
High cloud ..	1				0				0				0				0				0				20				68				12				0	80

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft.
 No information of the rate of motion of clouds is available. * Period for cloud motion: Sept. 1927-July 1935.

Table V—Wind direction and speed in the upper air 3 129

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)

II = 14-27 knots
(16-31 m.p.h.)

III = 28-40 knots
(32-47 m.p.h.)

IV = over 40 knots
(over 47 m.p.h.)

C = less than 3 knots
(less than 4 m.p.h.)

Muscat—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
APRIL																																		
Surface ..	.4	0	0	0	.8	0	0	0	.4	0	0	0	3	0	0	0	6	.4	0	0	3	0	0	0	13	.4	0	0	5	0	0	0	68	240
1,700 ..	4	0	0	0	4	0	0	0	4	0	0	0	1	.4	0	0	5	2	0	0	16	3	0	0	31	12	2	0	17	1	.4	0	4	239
3,300 ..	3	.4	0	0	1	0	0	0	2	0	0	0	2	0	0	0	4	.8	.4	0	17	3	0	0	26	13	1	.4	13	7	.4	0	6	238
6,500 ..	6	.9	0	0	6	0	0	0	3	0	0	0	4	0	0	0	2	0	.4	0	8	4	.4	0	17	14	2	0	17	12	2	.4	4	231
10,000 ..	8	1	0	0	8	.9	0	0	4	1	0	0	.9	0	0	0	1	0	0	0	3	2	2	0	9	.21	9	.5	12	12	4	.5	.5	214
Low cloud ..		1				3				0				3				1				23				47				23			0	51
Medium cloud ..		0				0				0				0				1				26				54				19			0	57
High cloud ..		1				0				0				0				0				29				58				12			0	123
MAY																																		
Surface ..	2	0	0	0	1	0	0	0	1	0	0	0	2	0	0	0	7	0	0	0	6	.4	0	0	14	0	0	0	7	0	0	0	59	246
1,700 ..	2	0	0	0	2	0	0	0	.4	0	0	0	1	0	0	0	2	0	0	0	17	4	0	0	26	22	2	0	14	3	0	0	3	242
3,300 ..	2	0	0	0	2	.8	0	0	.8	0	0	0	.8	0	0	0	4	.4	0	0	12	1	0	0	24	24	3	0	13	7	.8	0	4	245
6,500 ..	6	.4	0	0	3	.4	0	0	4	0	0	0	2	0	0	0	6	.4	0	0	5	.8	.4	0	17	15	.8	.4	10	19	3	0	6	241
10,000 ..	7	.9	0	0	6	.5	0	0	4	6	0	0	2	.9	0	0	2	.9	0	0	3	3	.5	0	17	15	2	.5	14	12	2	0	1	214
Low cloud ..		0				6				6				0				0				32				51				3			0	95
Medium cloud ..		0				0				0				0				0				52				48				0			0	17
High cloud ..		0				0				0				0				0				50				43				6			0	59
JUNE																																		
Surface ..	3	0	0	0	2	0	0	0	2	0	0	0	3	0	0	0	3	0	0	0	3	.8	0	0	11	.4	0	0	5	0	0	0	67	240
1,700 ..	3	0	0	0	5	0	0	0	1	0	0	0	3	.8	0	0	3	0	0	0	10	1	0	0	28	14	0	0	21	3	0	0	5	239
3,300 ..	8	.4	0	0	5	.8	0	0	3	0	0	0	2	.4	0	0	2	.4	0	0	7	.4	0	0	17	13	0	0	23	14	.8	0	2	237
6,500 ..	16	11	0	0	7	2	0	0	5	.9	0	0	3	0	0	0	3	.4	0	0	6	1	0	0	6	5	.4	0	16	16	2	0	.4	232
10,000 ..	10	10	0	0	19	8	.5	0	10	5	1	0	6	1	0	0	2	0	0	0	4	3	.5	0	4	3	0	0	6	4	1	0	2	203
Low cloud ..		0				17				19				2				0				18				23				24			0	13
Medium cloud ..		12				12				46				7				14				2				2				4			0	50
High cloud ..		0				22				49				21				0				7				0				0			0	28

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft.
No information of the rate of motion of clouds is available.

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)

II = 14-27 knots
(16-31 m.p.h.)

III = 28-40 knots
(32-47 m.p.h.)

IV = over 40 knots
(over 47 m.p.h.)

C = less than 3 knots
(less than 4 m.p.h.)

Muscat—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV						
JULY																																						
Surface ..	4	0	0	0	15	0	0	0	5	0	0	0	3	0	0	0	3	0	0	0	3	0	0	0	3	0	0	0	9	0	0	0	2	0	0	0	55	238
1,700 ..	8	0	0	0	7	0	0	0	7	9	0	0	10	4	0	0	4	0	0	0	4	0	0	0	4	4	0	0	18	6	4	0	22	1	0	0	10	229
3,300 ..	11	4	0	0	5	4	0	0	4	4	0	0	3	0	0	0	3	0	0	0	8	0	0	0	8	0	0	0	28	7	4	0	17	7	1	0	5	235
6,500 ..	15	6	0	0	9	2	0	0	3	1	0	0	1	0	0	0	5	0	0	0	8	0	0	0	8	0	0	0	11	3	9	0	21	15	5	0	2	221
10,000 ..	20	10	0	0	16	9	1	0	6	6	0	0	3	0	0	0	2	0	0	0	2	0	0	0	2	0	0	0	6	5	0	0	10	5	5	0	3	189
Low cloud ..	4				26				31				1				0				0				0				26				17				0	36
Medium cloud ..	7				33				43				6				1				3				0				3				3				1	110
High cloud ..	0				13				78				5				0				0				0				0				3				0	45
AUGUST																																						
Surface ..	5	0	0	0	12	0	0	0	6	0	0	0	3	0	0	0	4	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	9	0	0	0	65	217
1,700 ..	7	0	0	0	6	0	0	0	9	0	0	0	16	0	0	0	4	0	0	0	2	0	0	0	18	0	0	0	18	0	0	0	16	5	0	0	21	205
3,300 ..	10	5	0	0	6	1	0	0	6	0	0	0	2	0	0	0	4	0	0	0	11	5	0	0	11	5	0	0	22	0	0	0	25	4	0	0	9	209
6,500 ..	21	4	0	0	13	2	0	0	6	1	0	0	1	0	0	0	1	0	0	0	2	0	0	0	7	2	0	0	7	2	0	0	24	14	0	0	2	206
10,000 ..	24	9	0	0	23	9	0	0	7	3	0	0	4	5	0	0	0	0	0	0	2	5	0	0	2	5	0	0	1	5	0	0	8	6	0	0	3	199
Low cloud ..	0				19				25				2				8				2				26				17				2	20				
Medium cloud ..	11				37				19				7				0				7				12				8				0	90				
High cloud ..	1				15				76				8				0				0				0				0				0	45				
SEPTEMBER																																						
Surface ..	9	0	0	0	5	0	0	0	2	0	0	0	2	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0	4	0	0	0	2	0	0	0	79	214
1,700 ..	10	5	0	0	2	0	0	0	4	0	0	0	4	0	0	0	4	0	0	0	6	0	0	0	33	1	5	0	18	5	0	0	18	5	0	0	16	206
3,300 ..	22	4	0	0	6	5	0	0	2	0	0	0	2	0	0	0	5	0	0	0	6	5	0	0	13	1	0	0	13	1	0	0	30	5	0	0	6	211
6,500 ..	29	13	0	0	18	8	0	0	7	1	0	0	2	0	0	0	1	0	0	0	1	5	0	0	1	0	0	0	1	0	0	0	11	4	0	0	2	208
10,000 ..	13	7	0	0	20	27	2	0	9	7	2	0	2	0	0	0	4	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	3	2	0	0	2	200
Low cloud ..	8				11				2				5				13				10				15				36				0	30				
Medium cloud ..	2				4				30				18				7				29				5				4				0	28				
High cloud ..	0				0				54				45				0				0				0				0				0	15				

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft.
No information of the rate of motion of clouds is available.

Table V—Wind direction and speed in the upper air 3 131

TABLE V—continued

Number of occasions per 100 on which particular winds may be expected

I = 3-13 knots
(4-15 m.p.h.)

II = 14-27 knots
(16-31 m.p.h.)

III = 28-40 knots
(32-47 m.p.h.)

IV = over 40 knots
(over 47 m.p.h.)

C = less than 3 knots
(less than 4 m.p.h.)

Muscat—cont.

Height above M.S.L. (feet)	N.				NE.				E.				SE.				S.				SW.				W.				NW.				C.	No. of obs.
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
OCTOBER																																		
Surface ..	.4	0	0	0	.4	0	0	0	.4	0	0	0	1	0	0	0	2	0	0	0	2	0	0	0	9	.8	0	0	2	0	0	0	82	243
1,700 ..	6	0	0	0	4	0	0	0	3	0	0	0	4	0	0	0	.8	0	0	0	7	0	0	0	38	3	0	0	24	.8	0	0	9	240
3,300 ..	14	.4	0	0	8	.4	0	0	8	0	0	0	3	0	0	0	5	0	0	0	7	0	0	0	18	2	0	0	23	4	0	0	7	243
6,500 ..	17	3	0	0	22	4	0	0	14	2	0	0	9	.8	0	0	2	0	0	0	4	0	0	0	3	.4	0	0	10	1	0	0	7	241
10,000 ..	9	3	0	0	19	11	2	0	14	14	0	0	7	.4	0	0	3	0	0	0	2	.8	0	0	2	.4	0	0	9	.8	0	0	3	236
Low cloud ..	2				10				23				8				11				17				19				10				0	42
Medium cloud ..	8				3				1				1				15				49				13				8				2	33
High cloud ..	0				0				0				0				5				67				27				0				0	28
NOVEMBER																																		
Surface ..	0	0	0	0	0	0	0	0	.4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	.4	0	0	0	88	237
1,700 ..	10	0	0	0	5	0	0	0	8	0	0	0	6	0	0	0	.9	0	0	0	4	0	0	0	26	2	0	0	31	0	0	0	7	231
3,300 ..	13	.8	0	0	14	0	0	0	12	.4	0	0	6	0	0	0	1	0	0	0	4	0	0	0	14	2	0	0	23	4	0	0	8	236
6,500 ..	14	.9	0	0	11	.4	0	0	18	7	0	0	6	.9	0	0	3	0	0	0	8	.4	0	0	8	.4	0	0	15	5	0	0	5	228
10,000 ..	10	2	0	0	14	3	0	0	8	5	.4	0	5	.9	0	0	6	.4	0	0	9	2	0	0	11	6	.4	0	8	7	0	0	2	224
Low cloud ..	18				4				8				2				10				13				22				25				0	63
Medium cloud ..	0				0				0				0				1				67				22				8				0	17
High cloud ..	0				0				0				0				0				47				52				1				0	107
DECEMBER																																		
Surface ..	.4	0	0	0	.4	0	0	0	0	0	0	0	2	0	0	0	4	0	0	0	5	0	0	0	14	0	0	0	6	0	0	0	68	233
1,700 ..	7	2	.4	0	5	0	0	0	6	.4	0	0	8	.4	0	0	4	.4	0	0	3	.9	0	0	16	10	0	0	25	5	.4	0	7	231
3,300 ..	11	.9	0	0	8	0	0	0	8	.9	0	0	5	0	0	0	3	.4	0	0	8	.4	0	0	9	5	.4	0	24	8	0	0	7	229
6,500 ..	14	2	0	0	7	.5	0	0	7	.5	0	0	3	1	0	0	4	0	0	0	6	1	0	0	12	8	.5	0	21	10	.5	0	2	210
10,000 ..	7	5	.5	0	1	2	0	0	2	0	0	0	.5	0	0	0	.5	2	.5	0	10	4	0	0	13	12	6	1	15	15	2	1	2	189
Low cloud ..	6				2				6				4				3				18				40				19				0	138
Medium cloud ..	6				0				0				3				0				16				51				25				0	40
High cloud ..	1				0				0				0				0				28				58				15				0	98

Authorities.—Bibliography Nos. 27, 39.

Note.—The approximate height of the clouds is as follows: Low cloud, 6,500 ft.; Medium cloud, 16,000 ft.; High cloud, 33,000 ft.
No information of the rate of motion of clouds is available.

TABLE VI—VISIBILITY AT COASTAL STATIONS
Percentage frequency of different degrees of visibility

Morning	BASRA (SHAIBAH)					BUSHIRE					BAHREIN									
	0500 (Z-3)					0900 (Z-3)					0730 (Z-3½)					0730 (Z-3½)				
	0-½	½-2	2-5	5-10	over 10	0-½	½-2	2-5	5-10	over 10	0-½	½-2	2-5	5-10	over 10	0-½	½-2	2-5	5-10	over 10
January	3	1	4	38	54	2	1	6	16	75	0	3	5	10	82	2	5	43	44	6
February	2	3	5	44	46	5	5	8	12	70	4	6	4	9	77	3	13	45	38	7
March .. ..	.7	2	5	42	50	1	2	5	12	80	0	1	3	7	89	.6	9	57	31	2
April .. ..	.4	1	5	37	57	.7	2	8	15	74	1	6	1	2	90	.7	5	51	39	4
May	1	2	4	18	75	1	3	4	12	80	0	2	.6	2	95	1	7	50	36	6
June	2	3	3	29	63	4	.5	7	22	62	3	6	5	6	80	5	15	58	21	1
July	2	3	10	22	63	5	5	8	19	63	6	8	6	4	76	13	19	39	23	6
August .. ..	.4	1	5	27	67	.4	4	6	14	76	.6	3	4	1	91	8	8	50	25	9
September	2	.7	1	15	81	1	.7	3	8	87	0	0	3	3	94	.7	5	39	35	20
October	1	1	.4	29	69	.4	.4	2	9	88	.6	3	.6	3	93	2	4	42	37	15
November	3	1	2	31	63	.4	1	0	7	92	0	0	1	5	94	3	3	47	31	16
December	4	1	2	29	64	3	1	7	17	72	.7	.7	3	3	93	2	4	47	24	23
Year	2	2	4	30	62	2	2	5	14	77	1	3	3	5	88	4	8	47	32	9
Afternoon	1600 (Z-3)					1530 (Z-3½)*					1530 (Z-3½)*									
January .. ..	.7	2	3	14	80	Data not available					0	.6	2	6	91	.6	1	4	73	21
February	2	4	9	14	71						1	6	6	6	81	0	6	13	76	5
March	6	5	7	8	74						.6	.6	3	6	90	.6	2	13	75	9
April	2	5	9	12	72						.7	2	4	.7	93	.7	4	13	78	4
May .. ..	.7	5	7	13	74						2	.6	2	3	92	.6	3	21	67	8
June	12	10	15	16	47						2	3	6	2	87	.7	11	40	46	2
July	13	10	11	17	49						4	7	6	4	79	5	10	24	44	17
August	5	10	10	15	60						0	3	6	4	87	.6	6	15	44	34
September	3	5	6	8	78						0	.7	1	4	94	0	3	9	57	31
October	1	4	4	9	82						0	.6	.6	6	93	0	.6	7	53	39
November	0	2	1	8	89						0	.7	.7	3	96	0	0	7	63	30
December	0	2	5	8	85						0	.7	3	2	94	0	0	5	62	33
Year	4	5	7	12	72						.9	2	3	4	90	.7	4	14	62	19

Table VI—Visibility at coastal stations 3 133

Authorities.—Bibliography Nos. 42 (Basra), 39 (Bushire and Bahrein). * 1730 (Z 3½) before July 1934.
Periods.—Basra, Mar. 1928-Feb. 1937 (omitting Mar.-Nov. 1932). Bahrein and Bushire, 1933-7.

TABLE VI—continued
Percentage frequency of different degrees of visibility.

Morning	SHARJAH					HENJAM					JASK					MUSCAT†				
	0800 (Z-4)					0800 (Z-4)					0800 (Z-4)					0800 (Z-4)				
	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	over 10	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	over 10	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	over 10	0- $\frac{1}{2}$	$\frac{1}{2}$ -2	2-5	5-10	over 10
January	0	1	7	14	78	1	2	6	9	82	.6	1	1	9	88	.6	2	6	43	48
February	6	2	20	10	62	2	4	1	25	68	2	2	4	16	78	.7	.7	3	33	63
March	3	1	13	15	68	0	2	4	42	52	.6	1	8	15	75	0	0	6	33	61
April	3	2	13	30	52	0	4	4	42	50	2	7	7	14	70	0	1	3	41	55
May	1	1	10	40	48	1	6	9	69	15	0	2	11	21	66	0	0	0	41	59
June	3	3	18	47	29	0	23	17	55	5	2	3	20	42	33	0	1	5	37	57
July	5	15	19	42	19	0	20	33	41	0	0	6	36	47	11	0	7	12	51	30
August	0	6	19	43	32	0	11	35	54	0	0	0	39	44	17	0	3	10	53	34
September	1	2	15	37	45	0	1	9	58	32	0	.7	11	27	61	0	0	1	37	62
October	5	.6	7	19	68	1	0	1	24	74	3	0	3	8	86	0	0	0	11	89
November .. ..	.7	0	3	14	82	0	1	1	7	91	.7	0	.7	1	98	0	0	0	21	79
December	1	.6	2	12	84	1	1	3	11	84	0	0	.7	.7	99	0	0	.6	28	73
Year	2	3	12	27	56	1	6	10	37	46	1	2	12	20	65	.1	1	4	36	59
Afternoon	1600 (Z-4)*					1600 (Z-4)*					1600 (Z-4)*					1600 (Z-4)*				
January	1	1	5	9	84	0	2	4	16	78	.6	.6	1	11	87	.6	3	4	43	49
February	2	4	15	16	63	4	3	4	21	68	.7	4	6	18	71	.7	.7	.7	40	58
March	0	0	14	11	75	0	3	4	31	62	0	1	10	29	60	0	.7	4	36	59
April	2	3	16	35	44	1	7	7	36	49	0	6	10	29	55	0	1	3	42	54
May	0	2	17	42	39	0	6	13	53	28	0	.6	17	22	60	0	0	0	41	59
June	3	5	22	54	16	1	13	20	54	12	2	7	22	48	21	0	0	7	38	55
July	6	17	18	49	10	8	16	18	57	1	.6	7	40	46	6	0	6	12	54	28
August	1	7	23	47	22	1	14	18	64	3	0	1	37	43	19	0	3	6	57	34
September	0	1	17	43	39	0	1	6	39	54	0	3	11	27	59	0	0	3	36	61
October	0	.6	6	29	64	0	0	0	21	79	0	1	5	14	80	0	0	0	13	87
November	0	1	3	16	80	0	1	3	1	95	0	1	5	7	87	0	0	.7	21	78
December	0	0	3	16	81	0	0	0	14	86	0	1	2	9	88	0	.6	2	24	73
Year	1	3	13	31	52	1	6	8	34	51	.3	3	14	25	58	.1	1	4	37	58

Authority.—Bibliography No. 39.

* 1600 (Z-4) before July 1934.

Periods.—Sharjah, Jask, Muscat, 1933-7; Henjam, 1933-5.

† From Jan. 1933 to July 1935 the observations were made at Baitul Falaj.

TABLE VII—MONTHLY FREQUENCY OF DIFFERENT AMOUNTS OF CLOUD

Number of days per 100 on which particular cloud amounts may be expected
The figures refer to tenths of sky covered by cloud. 0 = clear sky. Tr. = less than 1/20. 10 = overcast

Morning		BASRA (SHAIBAH)					BUSHIRE					BAHREIN									
Time of obs.	Cloud amount	0500 (Z-3)					0900 (Z-3)					0730 (Z-3½)					0730 (Z-3½)				
		0	1-3	4-6	7-9	10	0	1-3	4-6	7-9	10	0	Tr.-3	4-6	7-9	10	0	Tr.-3	4-6	7-9	10
January		37	23	10	18	12	26	25	8	25	16	45	16	11	22	6	27	26	13	22	12
February		50	16	10	14	10	34	25	7	22	12	57	11	6	18	8	46	10	11	18	15
March		49	19	9	15	8	37	25	11	21	6	62	6	9	15	8	47	17	9	19	8
April		40	28	9	16	7	41	24	9	20	6	67	9	9	10	5	40	18	9	16	17
May		35	32	11	16	6	42	29	10	15	4	70	14	6	6	4	57	17	10	10	6
June		89	9	1	.6	.3	93	5	1	.3	.3	99	.7	0	0	0	95	3	.7	1	0
July		68	27	2	2	1	85	11	2	.8	1	96	.6	3	0	0	72	12	6	8	2
August		69	22	4	4	.8	79	15	4	2	0	84	8	4	3	.8	63	23	6	7	1
September		84	10	3	2	1	86	12	.8	.6	.3	94	1	1	3	.7	86	11	2	1	0
October		68	21	5	6	.5	61	24	4	11	0	89	6	2	2	.6	70	13	8	9	0
November		46	24	10	16	4	28	32	11	25	4	56	15	9	12	8	33	21	11	29	6
December		43	22	8	17	10	25	28	12	26	11	44	15	14	18	9	17	29	13	28	13
Afternoon		1600 (Z-3)					1530 (Z-3½)*					1530 (Z-3½)*									
Time of obs.	Cloud amount	0	1-3	4-6	7-9	10	Data not available					0	Tr.-3	4-6	7-9	10	0	Tr.-3	4-6	7-9	10
January		17	32	10	30	11	Data not available					51	11	10	23	5	31	22	12	23	12
February		23	32	12	23	10	Data not available					52	11	11	18	8	48	15	8	18	11
March		30	27	10	24	9	Data not available					62	9	6	18	5	47	16	10	16	11
April		34	22	11	25	8	Data not available					72	5	9	6	8	42	9	7	22	20
May		35	30	8	23	4	Data not available					72	9	6	10	3	63	10	10	11	6
June		89	6	.8	.6	4	Data not available					100	0	0	0	0	94	3	.7	2	0
July		80	10	.3	.3	9	Data not available					97	2	.6	.6	0	74	16	7	3	0
August		76	15	2	2	5	Data not available					95	4	1	0	0	80	11	5	3	1
September		79	17	1	.3	3	Data not available					100	0	0	0	0	87	13	0	0	0
October		56	24	7	13	.3	Data not available					88	4	4	3	.6	73	14	5	8	0
November		23	30	15	26	6	Data not available					56	15	7	17	5	35	16	15	25	9
December		15	35	13	29	8	Data not available					45	18	9	14	14	20	26	14	28	12

Authorities.—Bibliography Nos. 42 (Basra), 39 (Bushire and Bahrein).
Periods.—Basra, 1929-40; Bahrein and Bushire, 1933-7.

* 1730 (Z-3½) before July 1934.

Table VII—Cloud amount at coastal stations

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TABLE VII—continued

Number of days per 100 on which particular cloud amounts may be expected
The figures refer to tenths of sky covered by cloud. 0 = clear sky. Tr. = less than 1/20. 10 = overcast

Morning																							
Time of obs.	SHARJAH					HENJAM					JASK					MUSCAT†							
	0800 (Z-4)					0800 (Z-4)					0800 (Z-4)					0800 (Z-4)							
	0	Tr.	3	4-6	7-9	10	0	Tr.	3	4-6	7-9	10	0	Tr.	3	4-6	7-9	10	0	Tr.	3	4-6	7-9	10
January	30	27	15	18	10	13	52	16	14	5	20	38	17	22	3	30	30	11	17	12			
February	32	25	13	12	18	22	47	7	10	14	40	25	14	13	8	41	24	6	16	13			
March	47	21	8	10	14	22	46	14	12	6	49	25	13	9	4	51	21	14	10	4			
April	52	26	6	7	9	21	40	9	15	15	51	26	9	11	3	51	29	7	11	2			
May	75	13	5	4	3	55	37	4	3	1	71	14	6	8	6	74	14	5	4	3			
June	81	9	4	4	2	61	20	5	9	5	73	15	6	6	0	70	14	4	7	5			
July	59	20	10	8	3	45	31	10	13	1	38	24	12	20	6	54	18	10	11	7			
August	56	26	8	8	2	36	42	13	9	0	27	26	24	15	8	59	8	11	13	9			
September	65	26	5	3	1	39	45	7	9	0	51	23	11	12	3	80	10	4	5	7			
October	56	32	5	5	2	29	63	5	2	1	70	25	2	2	6	82	9	8	6	0			
November	33	39	12	11	5	17	53	13	13	4	46	31	14	8	1	54	24	12	6	4			
December	10	44	21	16	9	6	53	12	17	12	26	41	11	15	7	48	22	8	14	8			
Afternoon																							
Time of obs.	1600 (Z-4)*					1600 (Z-4)*					1600 (Z-4)*					1600 (Z-4)*							
	0	Tr.	3	4-6	7-9	10	0	Tr.	3	4-6	7-9	10	0	Tr.	3	4-6	7-9	10	0	Tr.	3	4-6	7-9	10
January	31	31	11	15	12	22	44	12	12	10	23	35	15	19	8	33	31	8	20	8			
February	39	30	6	12	13	31	35	11	7	16	36	34	11	13	6	51	19	6	13	11			
March	49	15	11	18	7	33	38	15	5	9	48	24	14	10	4	47	20	11	12	10			
April	48	18	11	15	8	24	28	11	24	13	42	24	11	20	3	43	21	11	18	7			
May	69	18	5	4	4	48	40	1	7	4	65	20	8	5	2	67	17	8	6	2			
June	86	9	3	2	0	73	19	4	3	1	77	12	7	3	7	61	25	9	4	1			
July	62	27	4	6	1	56	30	10	4	0	59	27	8	5	7	61	18	8	8	5			
August	48	43	6	3	0	32	52	12	4	0	39	44	13	3	1	75	12	5	5	3			
September	53	43	3	1	0	51	48	1	0	0	66	33	1	0	0	83	6	4	7	0			
October	47	45	3	4	6	37	58	2	3	0	57	36	6	6	0	83	13	3	6	0			
November	29	36	15	15	5	14	55	13	12	6	36	38	13	12	1	47	27	5	8	13			
December	10	49	19	13	9	9	56	10	14	11	30	42	9	14	5	51	22	8	11	8			

Authority.—Bibliography No. 39
* 1800 (Z-4) before July, 1934.

Periods.—Sharjah, Jask, Muscat, 1933-7; Henjam, 1933-5.
† From Jan., 1933 to July, 1935 the observations were made at Baitul Falaj.

TABLE VIII—MONTHLY FREQUENCY OF DIFFERENT STATES OF THE SEA

Number of occasions per 100 on which particular states of the sea may be expected.

I = Calm, smooth or slight. II = Moderate. III = Rough. IV = Very rough or high. V = Very high or precipitous. VI = Confused.

Morning.

Time of obs.	BUSHIRE					BAHREIN					HENJAM					JASK					MUSCAT†									
	0730 (Z-3½)					0730 (Z-3½)					0800 (Z-4)					0800 (Z-4)					0800 (Z-4)									
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
January ..	80	6	9	4	.6	0	76	11	12	.7	0	0	80	10	10	0	0	0	82	11	6	.6	.6	0	79	16	4	.6	0	0
February ..	85	6	6	2	.7	0	75	13	10	2	0	0	93	5	2	0	0	0	83	8	6	3	0	0	84	11	5	0	0	0
March ..	88	2	7	2	.6	0	78	13	6	3	0	0	95	2	2	1	0	0	88	9	2	.6	0	0	92	5	3	0	0	0
April ..	86	7	3	3	1	0	79	10	8	3	0	0	93	5	2	0	0	0	89	6	4	1	0	0	90	9	.7	0	0	0
May ..	83	7	7	3	0	0	88	6	5	1	0	0	96	4	0	0	0	0	97	3	0	0	0	0	95	4	.7	0	0	0
June ..	71	9	16	3	.7	0	73	18	4	5	0	0	99	1	0	0	0	0	86	10	4	0	0	0	93	6	.7	0	0	0
July ..	91	3	6	0	0	0	93	6	1	0	0	0	93	5	2	0	0	0	77	16	7	0	0	0	90	9	1	0	0	0
August ..	94	2	3	.6	.6	0	91	6	3	0	0	0	86	12	2	0	0	0	81	14	5	0	0	0	97	3	0	0	0	0
September ..	92	3	4	.7	0	0	92	6	2	0	0	0	98	2	0	0	0	0	95	3	2	0	0	0	100	0	0	0	0	0
October ..	98	.6	.6	.6	0	0	93	4	3	0	0	0	99	0	1	0	0	0	96	4	0	0	0	0	99	.6	0	0	0	0
November ..	96	3	.7	0	.7	0	94	4	2	0	0	0	93	5	2	0	0	0	98	2	0	0	0	0	97	2	.7	0	0	0
December ..	66	11	20	3	0	0	78	18	3	.7	0	0	96	4	0	0	0	0	96	3	1	0	0	0	95	4	.6	.6	0	0

Afternoon.

Time of obs.	1530 (Z-3½)*					1530 (Z-3½)*					1600 (Z-4)*					1600 (Z-4)*					1600 (Z-4)*									
January ..	59	13	22	5	1	0	69	18	12	1	0	0	82	14	4	0	0	0	74	14	8	4	0	0	79	15	6	0	0	0
February ..	64	11	18	4	2	.7	59	23	14	4	0	0	83	10	6	1	0	0	62	20	11	7	0	0	82	15	3	0	0	0
March ..	65	12	14	9	0	0	66	24	6	4	0	0	85	7	7	1	0	0	70	19	8	3	0	0	89	10	1	0	0	0
April ..	53	12	26	7	2	0	66	17	15	2	0	0	78	13	9	0	0	0	76	14	7	3	0	0	90	9	.7	.7	0	0
May ..	57	14	20	5	4	0	74	19	6	.6	0	0	76	16	8	0	0	0	84	8	8	0	0	0	95	4	.7	0	0	0
June ..	52	13	25	9	1	0	60	24	11	5	0	0	88	11	1	0	0	0	75	19	4	2	0	0	93	4	0	0	3	0
July ..	75	12	12	1	0	0	72	18	9	.7	0	0	85	15	0	0	0	0	76	16	8	0	0	0	88	10	2	0	0	0
August ..	74	9	15	1	.6	0	74	17	8	.7	0	0	93	5	2	0	0	0	81	14	5	0	0	0	96	3	1	0	0	0
September ..	58	24	17	1	0	0	83	13	3	1	0	0	94	6	0	0	0	0	89	7	3	.7	0	0	98	1	.7	0	0	0
October ..	73	10	15	1	.6	0	82	12	6	0	0	0	96	4	0	0	0	0	82	13	3	2	0	0	99	.6	.6	0	0	0
November ..	70	15	10	5	0	0	83	15	2	0	0	0	96	3	1	0	0	0	86	9	4	.7	0	0	96	3	.7	0	0	0
December ..	66	11	20	3	0	0	74	19	6	1	0	0	91	9	0	0	0	0	79	13	8	0	0	0	94	5	.6	0	0	0

Authority.—Bibliography No. 39.

* Observations 2 hours earlier before July 1934.

Periods.—Bushire, Bahrein, Jask, Muscat, 1933-7; Henjam, 1933-5.
† From Jan. 1933 to July 1935, the observations were made at Baitul Falaj.

Table VIII—State of the sea at coastal stations

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